

ELECTRONICS

Australia

HIFI
NEWS

SEPTEMBER, 1975
AUST 80c* NZ 80c

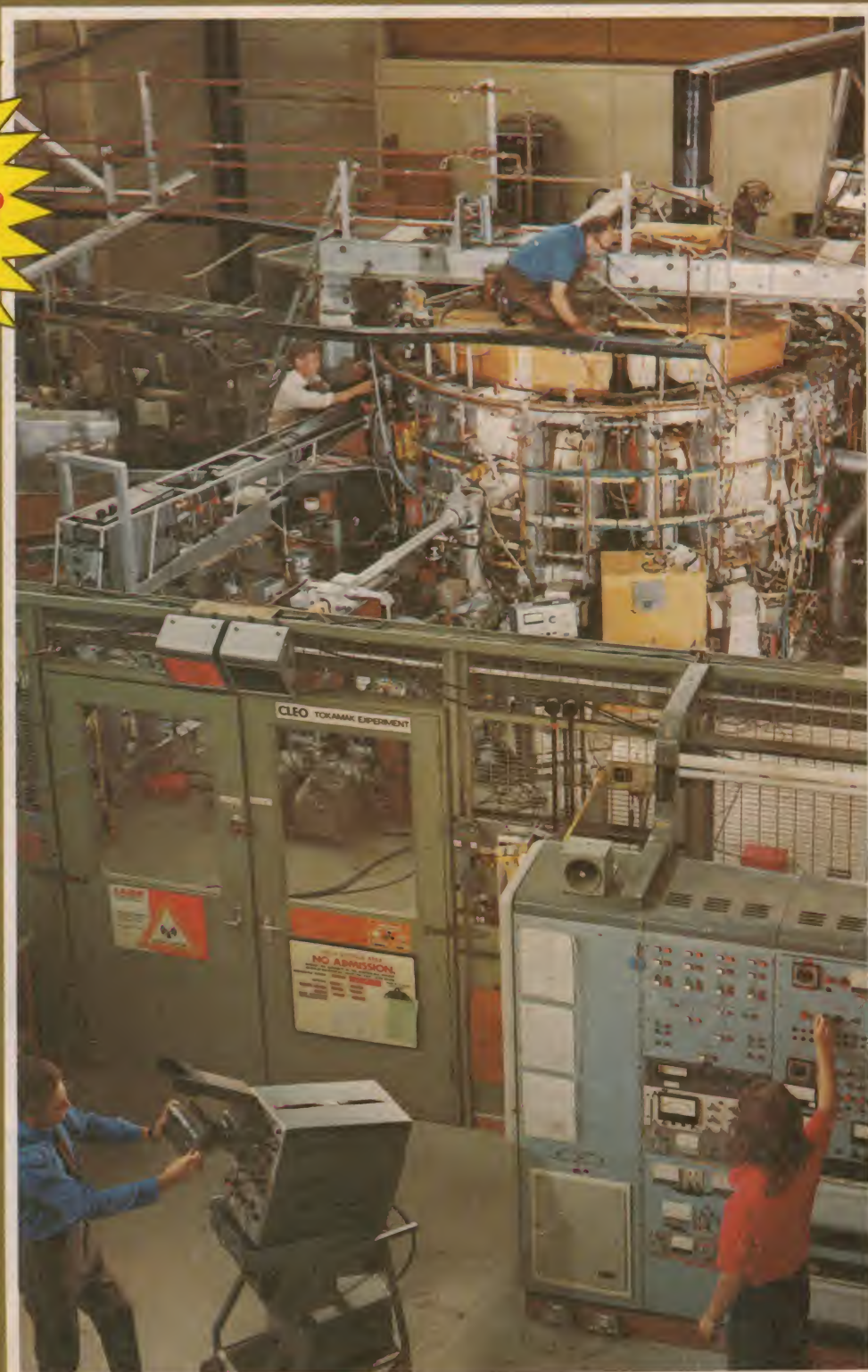
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**9 SIMPLE
PROJECTS!**

**COMPUTERS
FOR THE
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**BUILD YOUR
OWN 10GHZ
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CASSETTES**



FOR THE TRULY SENSITIVE LISTENER...

SONY PS 5550 Photo-Sensitive Auto Return Turntable
(no mechanics means a smoother trip)



Sony ends the old argument about automatic versus manual turntables magnificently with the new PS 5550.

Now you can enjoy the convenience of automatic return without the wear and tear, noise and other problems usually involved in mechanical detection.

The Sony PS 5550 really is an electronic marvel. Not only is the automatic return detection operated by photo-electric means, the large D.C. motor is electronically speed controlled.

Sony's renowned engineering excellence shows throughout the brilliant PS 5550. Performance is nothing less than sensational with wow and flutter at an amazingly low under 0.08% (DIN 45539) and signal/noise better than 65dB (DIN 45539).

How does Sony do it?

Firstly, rotation is always stable and accurate because the large, slow-speed D.C. motor is servo controlled.

Every micro-fluctuation in current automatically generates its own correction so the speed of motor and platter never vary. Then the turntable mounting is shockproof,

effectively insulating it from external vibrations, and even pushing the control buttons does not affect stability, because the controls and turntable sections are mounted on separate bases.

An illuminated stroboscope, with two vernier speed adjustment knobs, allows accurate control of pitch.

The tone-arm is a precisely engineered S type, statically balanced, with both direct-reading tracking-force gauge and anti-skate compensator. The headshell is the universal plug-in type. Operating controls are all neatly grouped in a strip on the front. They provide automatic set-down and arm return. Auto reject and manual operation is also provided.

Aesthetically, the PS 5550 is slim and beautifully simple. To sum it up, may we quote Australian Hi-Fi Test Laboratories: 'A superb turntable'

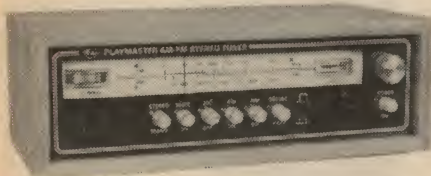
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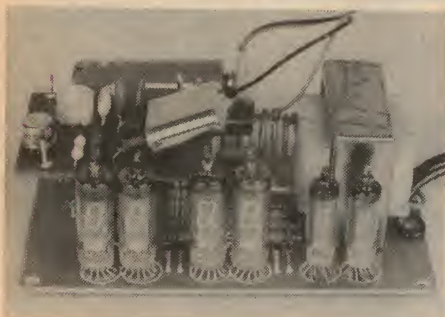
ELECTRONICS Australia

Australia's largest-selling electronics & hi-fi magazine

VOLUME 37 No 6



Here is a combined AM-FM stereo tuner that should make a worthy addition to any hi-fi system. The unit offers many attractive features, including AFC, delayed front end AGC and off station muting for FM, two tuning meters, and a dual selectivity AM tuner. See page 48.



Those who built the Fluorescent Readout LSI Digital Clock featured in the April issue should find this crystal-controlled 50Hz drive unit of particular interest. It will enable you to power your clock from a standby battery in the event of mains failure, or to adapt your clock to complete battery operation. Full details on page 74.

On the cover

A general view of the Cleo Tokamak apparatus used for nuclear fusion research at Culham Laboratory, UK. Part of the control room and diagnostics area are shown in the foreground, with the toroidal plasma confinement device in the background. For a description of current fusion research and the tokamak plasma confinement technique, readers are referred to an article entitled "Fusion Power: Energy for the Future" published last January. (Picture courtesy U.K.A.E.A.)

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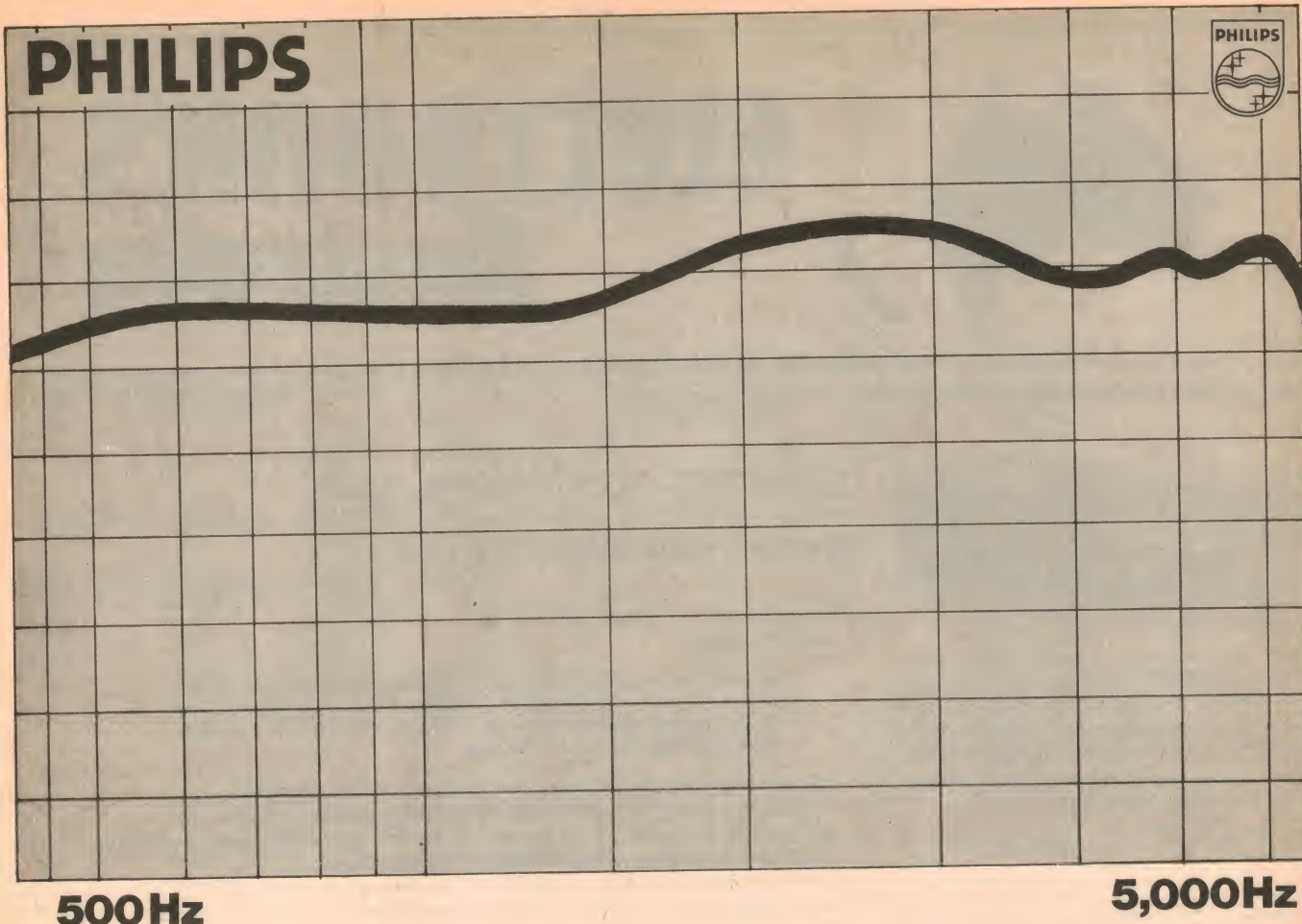
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PHILIPS



500-5,000Hz and it's almost flat. How's that for about \$50 worth!

It's the performance curve of Philips new mid range speakers. That curve is so flat it gives a variation of as little as ± 1 dB over the same frequency spread. And even beyond those levels the drop is gradual on either side. And to think



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— give or take
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Editorial Viewpoint

By way of explanation

Like most magazines, we at EA get quite a few letters from readers concerning magazine content. Many are complimentary, but inevitably some are critical. Whichever the case we read and consider each one, because they all provide valuable feedback information. Without them we would find it very much harder to produce a successful magazine.

Now I'm not saying we enjoy getting critical letters; far from it. No one enjoys learning that they have blundered, any more than they enjoy learning that they have a disease. But like nasty medicine, valid criticism is good for you in the long run, as Socrates pointed out long ago.

What we would like our critics to remember, though, is that we are simply a group of people trying to earn a living by providing a magazine you will hopefully find of interest and value each month. We don't claim to know all the answers, or to never make mistakes.

This applies particularly where our practical construction projects are concerned. In the university or government research lab, there is almost no limit to how far one can go in pursuing performance and design elegance. Even in a normal industrial situation, there is usually the opportunity to rationalise and go through a pre-production run before a design is crystallised.

Quite frankly, the economics of the magazine publishing are such that if we tried this sort of procedure, we'd go out of business. All we are able to do is produce a working prototype, test it as thoroughly and as stringently as we can, and if the results are good we publish.

We wouldn't be human if we didn't find this frustrating. Often we would love to be able to upgrade a design or make it more elegant. But we console ourselves with the belief that you would rather have a magazine with projects having the occasional bug, than have no magazine at all!

Also consoling is the knowledge that big manufacturers, despite their rationalisation and pre-production runs, still have to issue modification lists for some time after their designs have gone into production. As our serviceman noted in his column last month even an experienced and respected firm like EMI has had to do this with their colour TV sets, so perhaps we shouldn't feel too bad about a few small errors in a project like our EDUC-8 computer system.

So if we do produce a design now and again which gives you a few problems, I'd ask you to bear in mind the limitations under which it was produced.

Jamieson Rowe

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ON SALE THE FIRST MONDAY OF EACH MONTH.

Printed by Dalley-Middleton-Moore Pty Ltd, of Kent St, Sydney and Masterprint Pty Ltd of Dubbo, NSW, for Sungravure Pty Ltd, of Regent St, Sydney.

*Recommended and maximum price only.

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Subscriptions

Subscription Dept, PO Box M204, Sydney Mail Exchange 2012.

Circulation Office

21 Morley Ave, Rosebery, Sydney 2018. Phone 663 3911.

Distribution

Distributed in NSW by Sungravure Pty Ltd, 57-59 Regent St, Sydney; in Victoria by Sungravure Pty Ltd, 392 Little Collins Street, Melbourne; in South Australia by Sungravure Pty Ltd, 101-105 Weymouth St, Adelaide; in

Western Australia by Sungravure Pty Ltd, 454 Murray Street, Perth; in Queensland by Gordon and Gotch (A'asia) Ltd; in Tasmania by Ingle Distributors, 22 Argyle St, Hobart; in New Zealand by Gordon and Gotch (NZ) Ltd, Adelaide Rd, Wellington.

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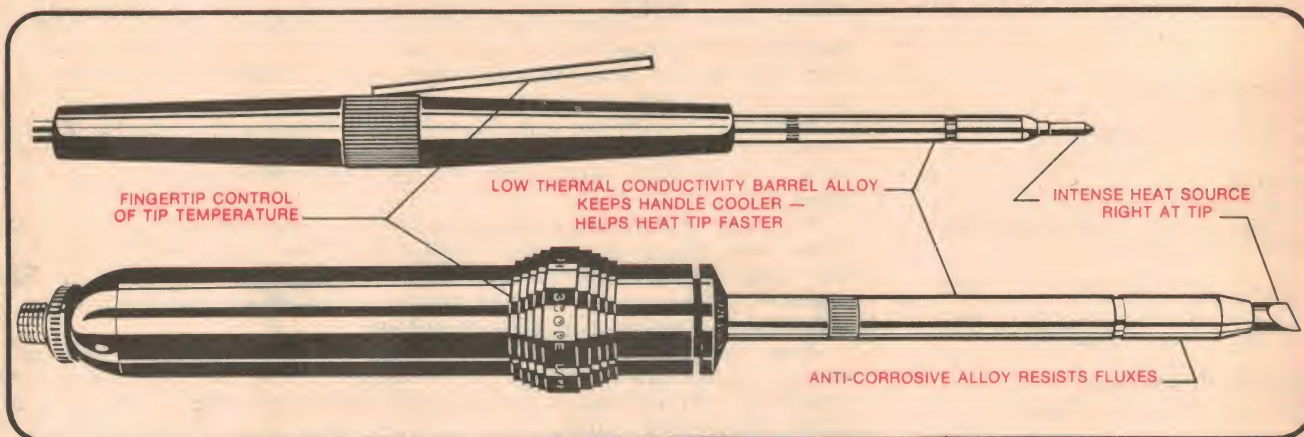
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What do ~~SCOPE~~ Superspeed Irons do best?



SCOPE TRANSFORMER

This transformer is specially designed to provide a safe low voltage power source for Scope Superspeed Irons (and Vibroscope etching tools). An earthed isolation shield prevents capacitive coupling with possible voltage leaks.



1. Provide intense heating power:

The patented heating concept located right behind the tip provides tremendous heat output to get the iron hot fast; then keeps the temperature under your control to complete every joint faster.

2. Let you control the power:

Should you encounter a heat sink which would rapidly drain away tip heat (e.g. thick metal or a need for plenty of molten solder) your finger switch provides another burst of heat to keep the copper tip at correct temperature. Normally only heavy irons have this capacity and take a long time to heat — and cool.

3. Put this heating power right at the tip:

A perfect iron has its heat source right at the surface of the tip — inefficient irons have their's up the barrel. The Superspeed range generate their heat on the copper tip itself, hence the intense concentration.

4. Lets the tip run cool when not actually soldering:

The tip stays tinned longer and lasts much longer because it switches off when you let go the handle. This feature plus a low heat conductivity stainless barrel keeps the handle cooler.

5. One iron replaces several:

With normal irons, you need several different sized irons to cope with various jobs and avoid the risk of dry or weak joints. Scope has designed an iron that does the work of any other iron from 10 watts to 150 watts.

SUPERSPEED USER SELECTION DATA

	Superspeed	Mini Superspeed
Low heat conductivity barrel	Yes	Yes
Non-corrosive barrel	Yes	Yes
Weight (without leads)	100 grm	50 grm
Heating up time for 40/60 solder from cold	5 sec.	5 sec.
Heating up time for aluminium solder from cold (450°C)	14 sec.	12.5 sec.
Heating up time for hard silver solder from cold (630°C)	32 sec.	29 sec.
A conventional iron to do the same work would need to be—	up to 150W	up to 75W
Diameter of barrel	9.5 mm	6.4 mm
Choice of copper tip shapes	Yes	No
Cable lugs fitted	Yes	Yes
User Preference Guide:		
Electronic Service work	TV with vac. tubes	Solid State equipment
Electronic and Hi Fi hobbies	2nd pref.	1st pref.
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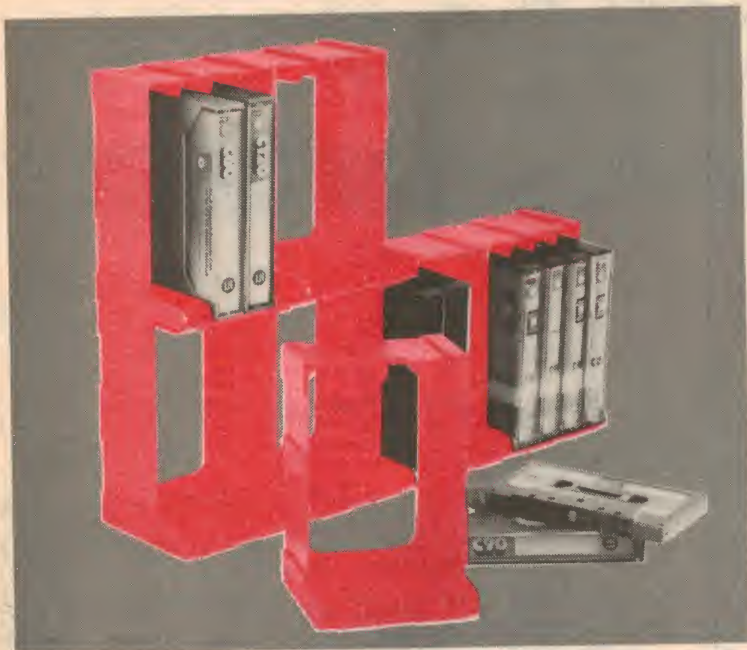


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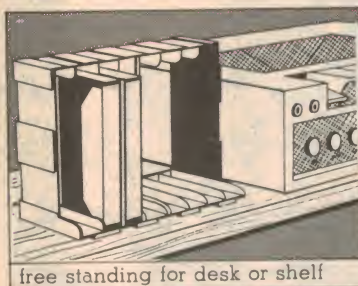
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here's an exciting new way to store and display your cassettes

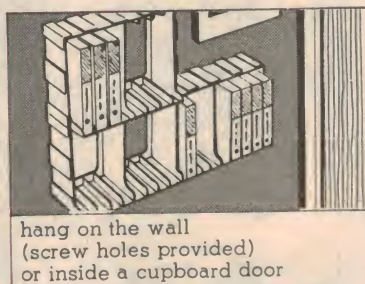


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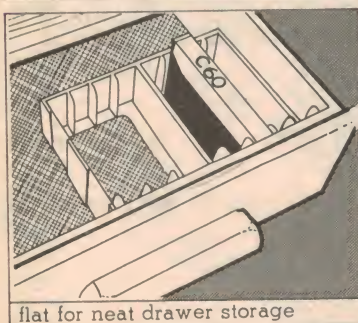
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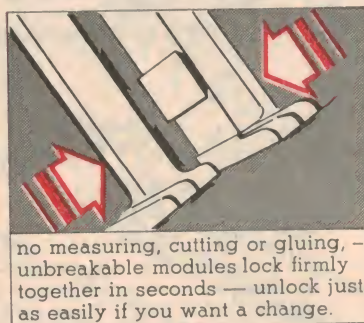
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(screw holes provided)
or inside a cupboard door



flat for neat drawer storage



no measuring, cutting or gluing, —
unbreakable modules lock firmly
together in seconds — unlock just
as easily if you want a change.

The BASF Modul-Lock Library is a unique new storage system that grows with your cassette collection, and opens up a thousand beautifully original display possibilities.

Each precision moulded polystyrol module holds four cassettes in individual slots. As you get more cassettes you simply lock in one or more extra modules. Any way you like — side by side, vertically, diagonally, staggered, L-shaped, free form.

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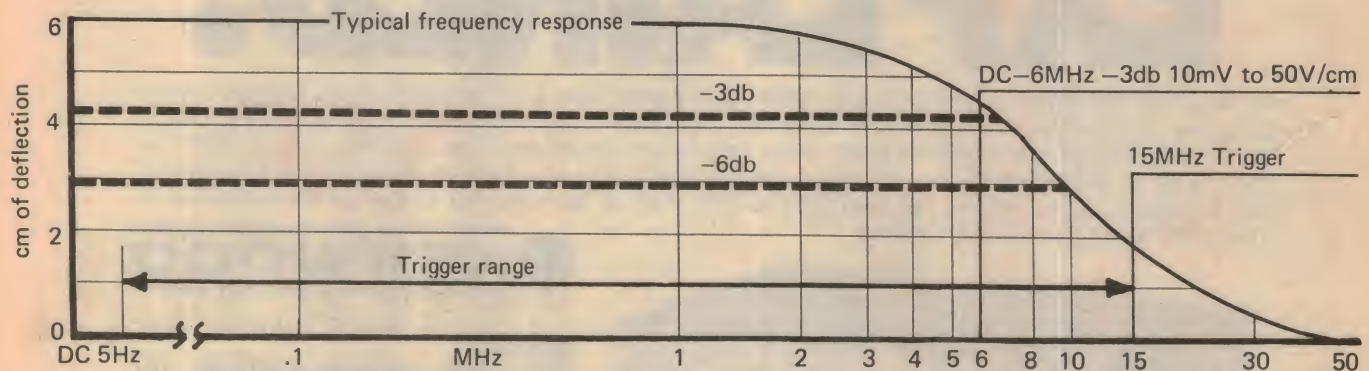


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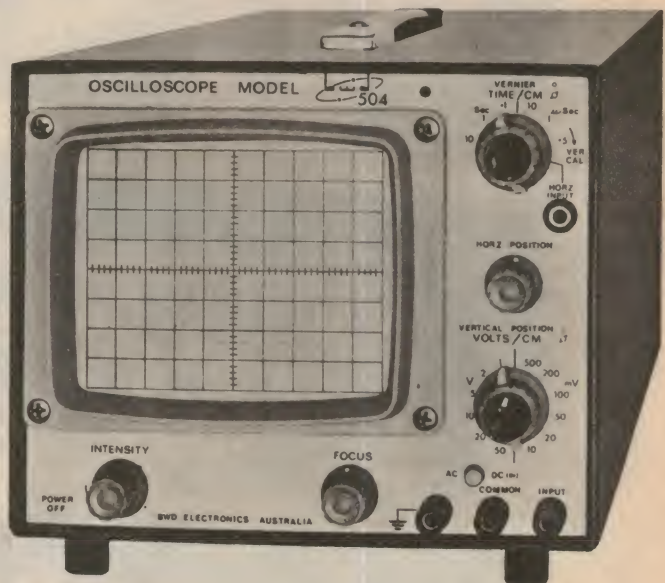


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AMPLIFIERS EXPLAINED:

An amplifier amplifies, or strengthens, the sound signal from your turntable or tape deck to your speakers. Obviously, the better the amplifier the better the sound from your speakers. Below are three excellent examples of what good amplifiers should be. They start at around \$200.00. And go up to around \$600.00. Which is another thing you must learn about Hi Fi equipment. Talk is cheap. Good sound reproduction is not. Ask to see the full range of Kenwood Hi Fi equipment at any good Hi Fi Centre.



KENWOOD



KA-1200G**

Power Output: 13 + 13 watts RMS into 8 ohms load at 1,000 Hz. Both channels driven. Total Harmonic Distortion: 0.8% at rated power into 8 ohms load. Power Bandwidth: 20 Hz to 40,000 Hz.

\$180.00*



KA-4006**

Power Output: 32 + 32 watts RMS into 8 ohms load at 20 Hz-20,000 Hz. Both channels driven. Total Harmonic Distortion: 0.5% at rated power into 8 ohms load. Power Bandwidth: 8 Hz to 45,000 Hz.

\$399.00*



KA-1600G**

Power Output: 20 + 20 watts RMS into 8 ohms load at 1,000 Hz. Both channels driven. Total Harmonic Distortion: 0.8% at rated power into 8 ohms load. Power Bandwidth: 20 Hz to 40,000 Hz.

\$285.00*

*Recommended Retail Price.
**Averaged manufacturers' specifications subject to change without notice.

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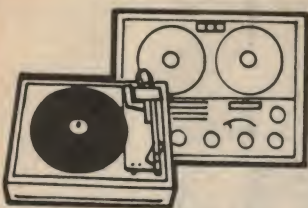
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Hi Fi News

Consumer Electronics Show report

In the role of US correspondent for "Electronics Australia", well known writer George Tillett reports on his visit to the Ninth Annual Consumer Electronics Show held recently in Chicago. While his concern was mainly with high fidelity equipment, he has some interesting observations about pocket calculators and the rapidly expanding Citizens Band market.

by GEORGE TILLET

The ninth annual Consumer Electronics Show was held as usual in Chicago's large exhibition hall-McCormick Place. Here nearly 40,000 dealers looked at more than 450 stands spread out over half-a-million square feet. The more energetic also took the time to see some of the hundred or more demonstrations which were held in hostels all over the town!

On show were calculators, Citizens Band radios, television sets, telephone answering machines, receivers, amplifiers, loudspeakers and tape recorders. A sizeable proportion of these products originated in the Far East and will be familiar to Australian readers so

I will pick out some of the American and European items of particular interest.

But first a few words about the quadraphonic scene; the claims and counterclaims are still to be heard but the excitement has died down and the new medium is accepted as an alternative to (2-channel) "stereo". Sales estimates vary from 5% to over 50% and dealers who take the trouble to demonstrate properly find it very much worthwhile. Shortage of records didn't help but there are now more than 1000 CD-4 and matrix available.

More than 500 FM stations broadcast matrix records involving CBS-SQ or Sansui QS encoding. The National

Quadraphonic Radio Committee has completed its field tests of various non-matrix systems and a draft report will be submitted to the FCC in due course. All the so-called discrete systems tested (RCA, Zenith, GE, etc) degrade the signal-to-noise ratio by 4 to 8db and it is quite on the cards that no system will be recommended. We shall see.

Meanwhile, back at the Show, a demonstration called Quad-a-Rama was well attended and there were a great number of new quadraphonic receivers to be seen. Onkyo still make the only receiver with automatic CD-4 to SQ switching and Sylvania showed four new models with special controls which can rotate the sound image 90, 180 or 270 degrees. I can't think of any use for such a control unless you want to play at being a recording engineer and "pan" a soloist around the room!

The majority of receivers provide both



Above: Representing an unusual approach to loudspeaker design, this new 3-way system from the Electrostatic Research Company (ERC) uses a 10-inch woofer firing into the top of an enclosure to cover the bottom end of the range. Attached to the back of the woofer is a structure containing a 3½-inch midrange, facing upwards, and a ring of eight electrostatic tweeters.

Cheek by jowl with every conceivable brand of hifi gear at the CES show were calculators ranging down to \$US10 for a 7-digit model with algebraic logic. Pictured at left is the Checkmaster which enables shoppers to keep track of their bank balance, indicating when it is overdrawn and by how much. A little larger than a cheque book, it sells for under \$US40.

CD-4 and SQ facilities, with Sansui and one or two others giving a choice of QS decoding as well.

There were more than 40 calculator manufacturers represented, with models ranging from \$10 to over \$200 for print-out units. One of the \$10 models is made by Commodore and it features algebraic logic, floating decimal with seven digits and provision is made for an AC adaptor-fantastic value for money!

But a unit that really intrigued me is called the CheckMaster which is a trifle larger than a cheque book. Open it up and your bank balance is displayed on LED indicators. When you issue a cheque, press the keys accordingly and the new balance shows. Deposits are



DOES IT PAY TO BUY AN AMPLIFIER THIS GOOD?

Sony research takes the art of amplification a giant step forward...

First, Sony developed an entirely new, highpower transistor, the Vertical FET (V-FET). Unlike any conventional bipolar transistor or the regular FET used in FM tuners, this semi-conductor has all the characteristics of the classic triode vacuum tube, assuring a high current utilization ratio and uniform thermal flow for exceptionally stable operation under varying conditions.

Second, Sony used its new V-FET technology to build an amplifier which meets today's exceptional needs: great power delivered with the smooth "open" sound, long thought the exclusive attribute of vacuum tubes. At the same time all the proven benefits of advanced solid state, particularly high stability and reliability have been retained.

Result: The Sony TA 8650, a truly magnificent integrated amplifier which gives 80 + 80 watts of musical sound so "real" it lives.

The fidelity is unsurpassed with distortion levels so low they're nearly unmeasurable!

Pre-amp: 0.03% THD at rated output; Power amplifier: 0.05% or less @ 1kHz, @ 1W; 0.1% or less, 20Hz - 20kHz @ rated output.

Frequency response curves for high level inputs are ruler flat (+0, -2dB) from 10Hz to 100kHz. Phono equalization is also unusually impressive, corresponding to the RIAA curve $\pm 0.2\text{dB}$.

Yet these ultra specifications alone can't indicate the unit's unexcelled performance under musical conditions, with transient and phase response never attained in normal solid state construction.

Now, great power and superb, natural fidelity come in a package along with literally dozens of application and facility features, typical of Sony design ingenuity. To list a few: high quality professional LED clipping level indicator to show overload, complete FET protection circuits which prevent circuitry or speaker damage, complex professional controls designed for utmost accuracy and precision, including instant 20dB muting volume control, and level control memory. Tape monitor and dubbing facilities are thoroughly professional and very comprehensive, as are the rear panel connection facilities.

With the arrival of the new Sony TA 8650, perfection in an amplifier is close at hand. Naturally, that costs a little more.



SONY®
Research makes the difference

GAC S. 7533



Removing the grille from this ESS AMT-4 system reveals a 10-inch air suspension woofer and a Heil Tweeter or "air motion transformer" which radiates high frequency energy by squeezing air between the folds of a corrugated metallic ribbon.

made in the same way and if you are overdrawn, that amount is shown! The CheckMaster costs just under \$40—but I doubt whether the name will be popular among our Women's Lib members!

One area where business is booming is in CB (Citizens Band radio) and there are nearly 6,500,000 now in use. Statistics show that 1 car in 33 is equipped and sales forecasts are over 1,000,000 for 1975. There are 23 channels available in the allotted 27MHz band and almost anyone can get a licence. In fact, if the output is 100mW or less, no licence is required.

There were a large number of high power amplifiers on show and one of the centres of attraction was the BGW stand. This relatively small company supplied amplifiers that provided the "earthquake" for cinemas showing the Sensurround film. Banks of horn-loaded speakers were used and the voice coils have to withstand 1000 watts of power.

Makers of the loudspeakers are Cerwin-Vega, a Los Angeles based company noted for high power systems. BGW make amplifiers from 85 watts up to 1000 watts and provision is made for parallel operation if more power is required.

Harman-Kardon were showing their new Citation 16 power amplifier which uses two banks of LEDs for power indication. Rated power is 150 watts per channel at less than 0.1% distortion. Hum and noise is given as 100dB below rated output and the square wave rise time is 3uS.

ESS and SAE had new amplifiers rated at 250 watts per channel and Infinity were demonstrating their Class-D amplifier which was in a prototype stage at last year's Show. Class-D amplifiers are sometimes called "switching amplifiers", as the output stage is switched on and off at a fast rate, the objective being to minimise output stage current and dissipation. Switching rate of the Infinity amplifier is 500kHz but the power supply is also switched so efficiency is very high—well over 90%. The power supply frequency is 25kHz and heat dissipation is quite low. The unit measures 17" wide, 11" deep by only 3" high and turns the scales at 24 lbs. A matching preamp features a dynamic range expander and a noise-signal cross-correlation circuit



Displayed at Chicago, this Accousound system uses an 8-inch driver back loaded into a column which decreases in cross-section until finally terminated by a 10-inch passive radiator. A dome tweeter looks after the high frequencies.

which increases signal to noise by 10dB or more.

But for me, the most interesting items at the Show were the loudspeakers and they came in all shapes and sizes and used every known (and unknown) acoustic principle. There was one housed in a glass enclosure (very clinical-looking) and, among the cone materials, were paper, plastics, shot glass, expanded polystyrene, titanium and aluminium. And then there was the Kenwood range using pulp made "from the wood of the Daphne tree"!

In 1972, a company called Ohm introduced a loudspeaker system using a transmission line principle. The driver was a dynamic type but it was vertically mounted so it "fired" into an enclosure underneath. Radiation was from the outside of the cone which was made of

paper, titanium and aluminium measuring some 18 inches high by 10 inches in diameter. The whole system was very large and the enormous mass of the cone made it rather insensitive, so a smaller system was marketed a year or so later. Now Ohm have designed an even smaller system using a driver 9 inches high and 8 inches in diameter. It "fires" into a 1 cubic foot enclosure which has a 10-inch passive radiator mounted at the rear to augment the bass.

Another system using a downward mounted woofer is made by ERC but, around the top of this speaker (a 10 inch model) is a circular array of 8 electrostatic elements. They were designed by Arthur Janszen and are single-sided units with a spiral electrode. Provision is made for self polarizing (part of the program signal is stepped up by a transformer and then rectified to give a DC potential of about 900 volts).

A new model was announced at the Show, a 3-speaker version with a 3½ inch cone midrange unit facing upwards.

A more elaborate dynamic-electrostatic hybrid was being demonstrated by RTR; it used two 10-inch bass speakers with a circular array of 24 electrostatic elements, all mounted in a column-type enclosure. Crossover frequency is 400Hz and the amplifier for the ESL section is built-in.

In 1973 or thereabouts, a company called ESS caused quite a stir in audio cir-



Designed by Jose Bertagni and manufactured by BES Geostatics, these floor-standing flat loudspeaker systems use expanded polystyrene diaphragms handling middle and lower frequencies, with tweeters in the corners to handle the treble. The models shown are D50, D60 and D120.



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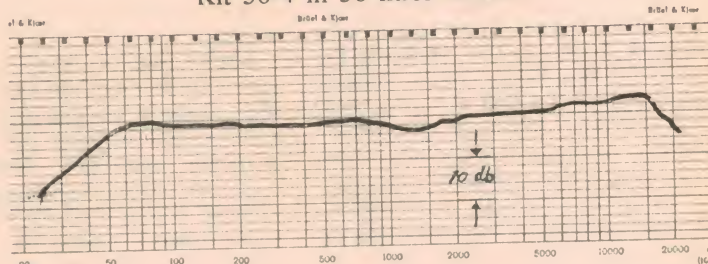
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HIFI NEWS

cles when they introduced the Heil high frequency speaker unit, designed by Dr Oscar Heil. Instead of a piston-like diaphragm, the Heil units use a corrugated ribbon which is mounted in a strong magnetic field. It does not vibrate the air; it squeezes it, so increasing the velocity. It can be considered as an "air motion transformer" giving a gain of 5:1.

Several systems using a Heil unit are available, with crossover frequencies from 400 to 1000Hz, depending on the size. For example, a new model released at the Show used a 12-inch bass speaker with a small Heil unit crossing over at 1000Hz. The total radiating area of the high frequency unit is 22½ square inches and system dispersion is 120 degrees horizontal and 40 degrees vertical. The enclosure is tube vented and measures 24" by 14" by 13". A prototype Heil unit going down to 30Hz has been demonstrated and Heil headphones were introduced recently.

Accusound were showing a new system using a kind of labyrinth but it dif-

THE NOISE PROBLEM

The Australian Acoustical Society will hold its 1975 conference "Planning For Noise" at the Hydro-Majestic Hotel, Medlow Bath, NSW on September 19-21.

The conference will examine noise in industry; transportation noise; noise in and around the home; noise in offices; sports and recreation noise; noise of demolition and construction.

Based on the concept of participation between delegates, the conference will be seeking answers in terms of legislation, planning, noise control, incentives, cost implications.

Information can be obtained from the Conference Registrar, Mr. D. Pickwell, 02-428-3009 or P.O. Box 80, Crow's Nest 2065.

ferred from the usual arrangement as the duct is terminated in a passive radiator. The duct cross-section decreases progressively so the air is at a high velocity by the time it gets to the passive unit, which has a diameter of 10 inches. The driven speaker is 8 inches and high frequencies are handled by a wide-dispersion 1½-inch dome unit. A larger model has a 6-inch midrange cone speaker with a 12-inch passive radiator and a 10-inch bass speaker.

Flat speakers are not new: there was the Ultra series in England way back in 1932 and the French Orthophase in the 1950's. The last named used a mylar diaphragm on which was bonded a zig-zag ribbon voice coil positioned between rows of bar magnets. Expanded polystyrene was glued to the diaphragm to suppress nodal resonances. The



Plessey Communication Systems have released their model PA3A18 solid-state amplifier, intended primarily for use as a P.A. system in offices, small factories and warehouses, etc. With a rated power output of 10W RMS, it can reasonably drive up to about 10 loudspeakers. To minimise clutter in reception or switchboard areas, the PA3A18 uses an inbuilt electret microphone. However, it has provision for an external plug-in microphone and also background music sources. There are separate slide faders for "Mic" and "Aux" and a 3-position tone control switch.

American-made Magnaplanars work on a similar principle but they are much larger, the standard model being about 6 feet high and 4 feet wide. Depth is just over 1 inch and it is folded at the centre so it looks rather like a room divider. The bass and treble sections are normally used with separate amplifiers and overall sound is unusually clean and uncoloured. Because they are doublets, i.e., they radiate in two directions, there is a certain amount of bass cancellation but this is not as serious as you might think.

Wharfedale in England and Yamaha in Japan use the same basic principle for headphones and, in both cases, the transparent sound quality is similar to that given by the best electrostatic types.

Another kind of flat speaker was first evolved by Yamaha some 10 years ago; it used an expanded polystyrene diaphragm that was tightly suspended so it vibrated, instead of moving air like a piston. Harmonic distortion at the lower frequencies was high and the speaker was only really suited for electronic organs.

Two years ago, Fisher introduced a similar model and this one could be hung on the wall as a picture. The inventor was Jose Bertagni, who has just formed his own company—BES Geostatics to make a range of flat speaker systems. They are floor-standing units and, although they look like dipoles, radiation at most frequencies is omni-directional. The

(Continued on page 17)



Pioneer have replaced their established line-up of amplifiers with six new models covering the power range from 20W RMS per channel to 110W. The corresponding recommended retail prices range from \$159 to \$929. A companion release involves 3 new AM/FM tuners, each envisaged as appropriate for two of the amplifiers. Tuner prices are respectively \$139 (SX-5300), \$249 (TX-7500) and \$359 (TX-9500). In the two top amplifier models, input and output connectors have been shifted from the traditional rear panel respectively to the right and left hand sides of the chassis. (Further information from Pioneer Electronics Australia Pty Ltd, 256-8 City Road, South Melbourne 3205.)

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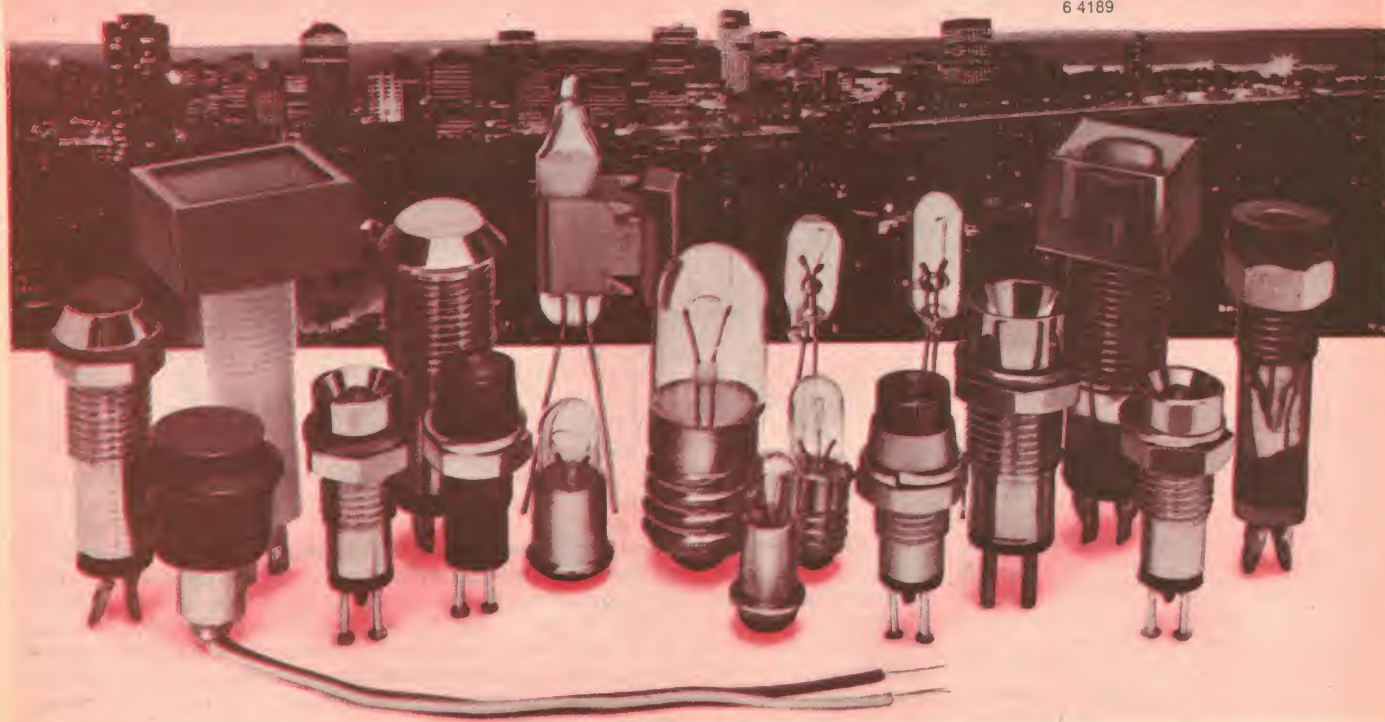
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Automatic Distortion Reduction

AKAI A.D.R. SYSTEM: HOW IT WORKS, WHAT IT DOES

A new circuit arrangement adopted by AKAI for use in their tape equipment should make it possible to record at an increased level relative to system noise, without running into high frequency overload problems. Known as A.D.R., or Automatic Distortion Reduction, it operates by dynamically modifying the high frequency pre-emphasis in accordance with the level of the input signal.

by NEVILLE WILLIAMS

For a tape system to be distortion-free, there must be a linear relationship between the signal input voltage and the ultimate output voltage to the amplifier. Each increment in signal voltage level must produce a proportional increment in output. In practice, this desirable objective is closely approached in good quality equipment, most of the time at most frequencies—assuming proper operation.

Unfortunately, however, the ratio between the loudest and softest passages in some program material is greater than the dynamic range of ordinary recording systems and it is difficult to avoid non-linearity at some frequencies, some of the time!

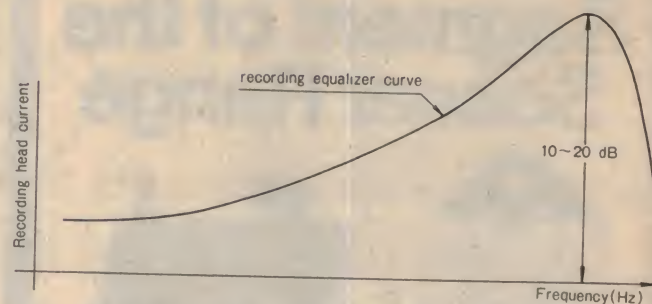
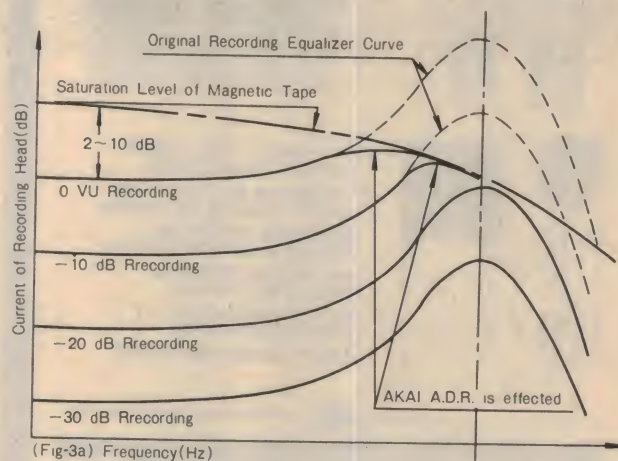
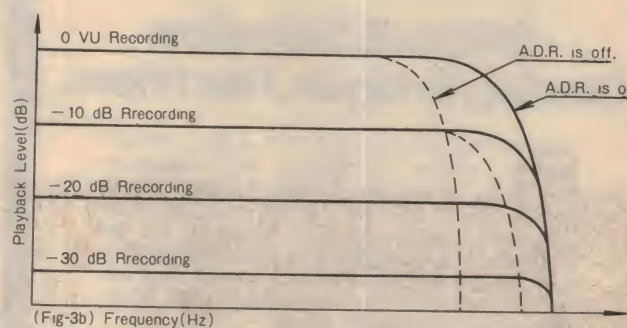


Fig-1 Recording Equalizer Curve for Cassette Tape Deck/Recorder



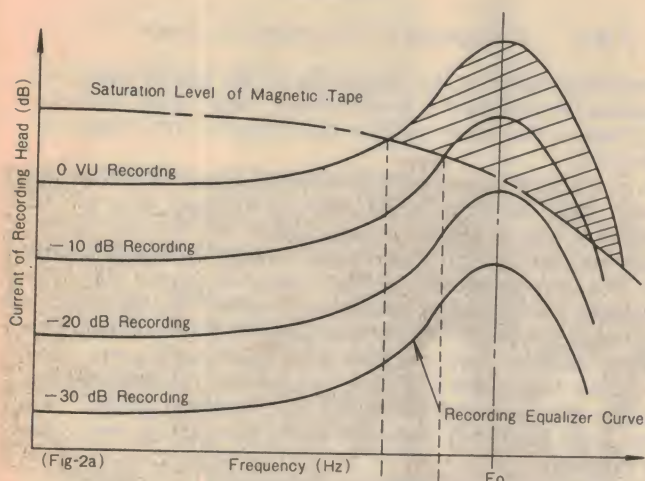
(Fig-3a) Frequency (Hz)



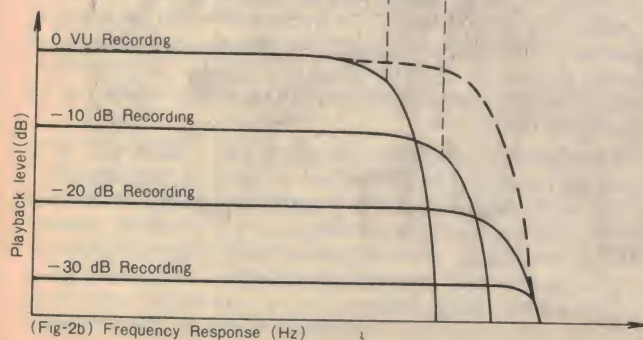
(Fig-3b) Frequency (Hz)

Fig-3a AKAI A.D.R. & Recording equalizer curve

Fig-3b Relationship between AKAI A.D.R. & Output Level



(Fig-2a)



(Fig-2b) Frequency Response (Hz)

Fig-2 Relationship between an input level and an output level

In a typical tape recording situation, difficulties can—and do—arise if too large a signal is fed through the system in an effort to swamp the inherent noise and achieve an especially high signal/noise ratio.

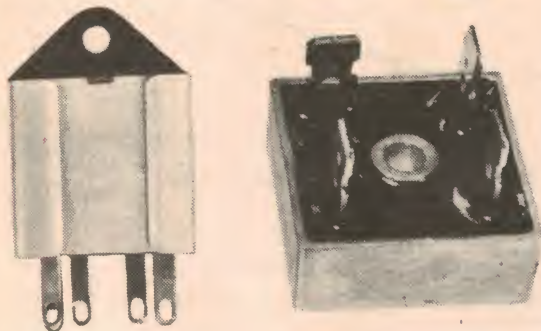
Quite apart from the actual amplifier circuits, there is a limit to the amount of signal current which can usefully be passed through a recording head. Above a certain level, the head or the tape coating itself becomes magnetically "saturated"; further increases in current do not produce any increase in the strength of the recorded field, and therefore no increase in the ultimate output from the tape into the replay head.

The problem can very easily arise with high-level, high-frequency signals.

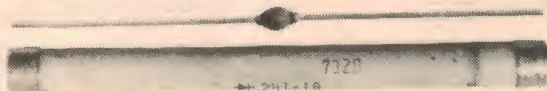
As indicated in Fig. 1, most tape (and particularly cassette) recorders include equalisation circuitry which progressively boosts the signal level with increasing frequency—a measure adopted in the interests of ultimate overall response and signal/noise ratio.

Behind the practice is an assumption that, in most common-

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Automatic Distortion Reduction

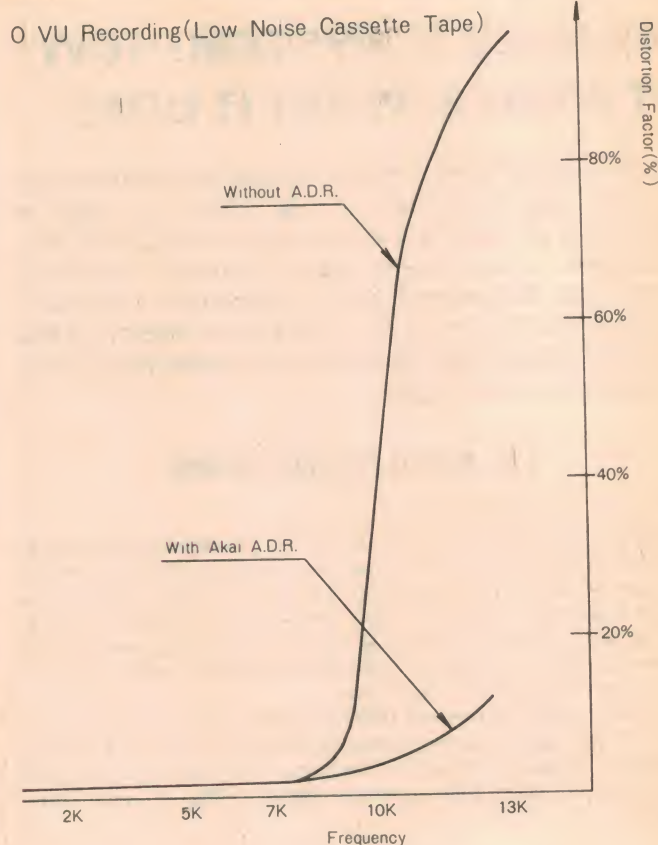


Fig-4 Comparison of The distortion factor

ly recorded material, the amplitude of the higher frequency components is modest, leaving enough "headroom" for boosting before the head and/or tape approaches magnetic saturation.

It is a highly convenient assumption but one that is not always valid. Some program material contains a surprising amount of high frequency energy and, if applied to a system which has wide response but limited dynamic range, the result can become apparent to the critical listener. The high frequency component is limited or "crushed" by the head or tape saturation and, while the resulting harmonics may not be directly audible, they can beat with other supersonic energy—noise, bias, pilot tone, etc, to produce a spurious and audible noise component during the overload peaks. As a result, high frequency transients suffer not only in amplitude but in quality.

Fig. 2 depicts the problem area in graphical form. If the signal components to be recorded are at an amplitude of -30dB or -20dB relative to 0dB VU , all frequencies can be handled without any problem. It is largely for this reason that overall response curves of tape decks are normally performed at -20dB VU —hopefully below head saturation level at all frequencies of interest.

At levels above -20dB VU (depicted as -10dB and 0dB) the plot of recording head current intercepts the saturation limit line well inside the normal audio passband. Instead of following the pre-emphasis contour, the recording characteristic for these higher level signals actually follows the saturation curve downwards with rising frequency. At the very least, therefore, the resulting losses at these amplitudes and these frequencies will equal the separation between the intended and the imposed curve.

In fact, AKAI engineers claim that the effects of magnetic

saturation are more profound than this. Head losses and tape demagnetisation compound the effect to produce even greater losses, as depicted in their Fig. 2b.

As well, magnetic saturation can lead to intermodulation and distortion at frequencies which would not otherwise be affected.

AKAI's answer to this problem is a system which causes the pre-emphasis characteristic to change dynamically with the nature of the input signal. With low-level or predominantly low frequency input signals, the pre-emphasis remains normal, ensuring optimum overall response. However, high-amplitude high-frequency signals are sensed immediately and the pre-emphasis is reduced to minimise or avoid head saturation.

Circuitry capable of sensing and responding to the amplitude and frequency content of the signal is now commonplace, as in Dolby and other anti-noise systems, and in quadraphonic logic and comparators. AKAI engineers have adapted the techniques to signal-dependent pre-emphasis.

Fig. 3 illustrates the effect of their A.D.R. system. It shows how the pre-emphasis contour is automatically lowered in the presence of a signal containing high frequency components at a level significantly above -20dB VU. While things may not happen quite as neatly as the curve suggests, the clear intention is to avoid the worst effects of magnetic saturation.



a) Input signal
(0 VU 700Hz - 10VU 15KHz)

b) Without A.D.R. (playback)

c) With A.D.R. (playback)

While the dynamic reduction in pre-emphasis will itself curtail the response to high amplitude treble, AKAI claims (Fig. 3b) that the measured loss is significantly less than is imposed by heavy saturation, followed by self-demagnetisation in the tape. More importantly, other overload phenomena are avoided—notably intermodulation effects and noise products injected back into the audible spectrum.

The end result, so AKAI claims, is a system which can be operated at a higher level with respect to internal noise, with less trauma in the presence of high amplitude treble transients. The transients sound cleaner because the intentional and momentary reduction in bandwidth is much less noticeable than an uncontrolled saturation overload.

An alternative approach would presumably have been to so arrange the circuitry that it would selectively compress high frequency transients, operating more in the manner of a peak limiter. But, rather than leave the pre-emphasis fixed and process the signal, AKAI engineers have come up with the interesting alternative: leave the signal itself untouched and use a dynamic filter to process the pre-emphasis!

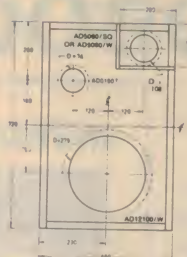
HI FI NEWS—Continued

diaphragms are shaped to control the various resonances and separate tweeters are mounted at the corners. The voice coils are coupled to the expanded polystyrene diaphragms through special plastic discs which equalise the response.

Finally, I must mention a British speaker which was introduced at the Show; it is made by Jordan-Watts and it consists of a 4-inch full-range unit housed in a ceramic jug. Appropriately enough it is called "The Flagon" and it weighs all of 28 lbs. It seems a great idea for do-it-yourselfers—"what are you doing with all those flagons?" "I'm making some speakers dd-dear; thash what!"

PHILIPS

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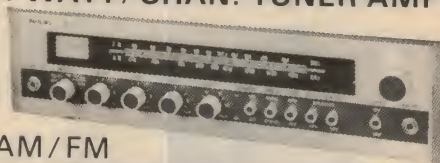
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Sony STR-7035 FM-AM stereo receiver



FM stereo receivers are now a big selling item on the local hi-fi market and most manufacturers have competitive models in several price ranges. Here is the Sony STR-7035 which is rated at 24 watts RMS per channel.

Sony market this receiver in two models, the STR-7025 and STR-7035. They are identical in features and performance except for their rated power output. While the STR-7035 is rated at 24 watts RMS per channel, the STR-7025 is rated at 18 watts per channel.

Styling of the receiver is apparent from the photograph and needs no other comment except to say that you could change the brand name on the front panel to any other Japanese manufacturer and few would be any the wiser. The hi-fi market is becoming very similar to the car market in this respect.

Dimensions are 427 x 149 x 345 mm (W x H x D) and weight is 8.6 kg. Weight of the lower powered STR-7025 is 8.5 kg.

The FM and AM dial calibrations are screen printed on the dial glass so they are visible whether the unit is turned on or off. Frankly, I prefer this to the inscrutable dials of some other receivers which are only visible when you turn them on.

A single tuning meter is provided for indicating signal strength on the AM and FM bands. We missed the facility of a centre-reading meter for correct tuning indication on FM. This is really a worthwhile feature which would be well

worth an extra few dollars.

On the right-hand side of the control panel is a large flywheel assisted knob for tuning, with a matching knob on the left-hand side for the volume control. Concentric with and below the volume knob is a small lever for the balance control, which operates through an arc of 120 degrees. It is very smooth in action and in some ways it seems more logical than a balance control with an operating range of about 300 degrees.

Four smaller knobs are provided for Speaker Selector, Bass and Treble controls and Function (Source) Selector. Push-buttons are provided for Loudness, Hi-Filter, Muting (FM), Mono and for connection to two separate tape or cassette recorders.

We are not pleased to note the inclusion of a microphone socket on the front panel together with its small mixing knob. I strongly suspect that this sort of feature is included merely because a competitive model has it. Much the same could be said of the Loudness facility and Hi-Filter, which rolls off at only 6dB/octave.

All the controls operate smoothly and effectively. In fact, the receiver is a pleasure to drive.

There are quite a few interesting features inside the receiver. First impression is that the unit is just a maze of hook-up wire. Most of the interboard connections are made via wrapped joints rather than by solder.

Following a recent trend, the power amplifiers utilise integrated circuits of the hybrid thick film variety which are mounted directly on a flat heatsink and soldered to a common PC board. The PC board also accommodates the power supply components, including the relatively high hefty filter electrolytic capacitors.

Thermal cut-outs, one for each channel, are mounted on the flat heatsink to provide protection from excessive power dissipation. These tripped several times during our power tests.

Balanced supply rails are used for the power amplifiers so that the output signal is directly coupled to the loudspeakers. Apart from the thermal cut-outs already mentioned, overload protection is provided by fuses in both legs of the transformer secondary winding.

In most respects, the preamplifier stages appear to be quite conventional. Tone control stages are active, rather than passive as in much Japanese equipment.

FM and AM tuner circuitry is accommodated on a separate large PC board. None of the tuner circuitry is shared—there are in effect two separate tuners. The multiplex decoder circuitry uses discrete components.

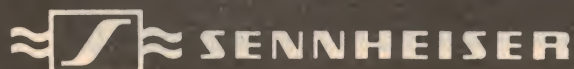
A very large PC board stretching across almost the full width of the receiver accommodates all the small signal circuitry and switching. An interesting feature is that the rotary Function and Speaker selector knobs actually operate "straight line" PC mounted switches via a nylon gear on the knob shaft.

A ferrite rod is provided for AM reception and this is housed within the confines of the chassis. This does have the advantage of being protected from damage, but it cannot always be oriented for best reception like an adjustable rod antenna as mounted on the rear of some other receivers we have seen.

Connections are provided at the rear of the chassis for an external 300 ohm ribbon or 75-ohm coax for FM reception.

Rated power of the STR-7035 is 24 watts RMS per channel into 8-ohm loads,

(Continued on page 23)



HEADPHONES

Sennheiser's revolutionary "Open-Aire" headphone design brings a new concept to stereo sound. This outstanding "Open-Aire" principle has to be heard to be believed, and for the first time 3-dimensional sound is now possible.

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Sound Technology's 1700A measures THD down to .002%—automatically!

As high fidelity equipment has improved in quality its performance has become increasingly difficult to measure. Now, Sound Technology has produced the model 1700A Distortion Measurement System which pushes back the previous limits to distortion measurement.

In recent years many audio amplifiers have outperformed much of the available distortion measuring equipment. In fact, any amplifier with a total harmonic distortion much below 0.1% is unlikely to be measured with any real precision by the bulk of distortion measuring equipment currently in use.

This is because the residual distortion of the measuring equipment itself, i.e., the residual distortion of the audio oscillator and the minimum distortion able to be measured by the distortion test set, must be at least one third of that of the amplifier or piece of equipment under test.

Thus, if the residual distortion of your measuring equipment is known to be 0.03%, for example, and your tests of a certain amplifier yield results which are all in the region of 0.02 to .04%, say, then

the results are utterly meaningless.

Yet these sorts of test results continue to be published in other magazines with absolutely no qualification or mention of their dubious validity.

So there is considerable need of a distortion test set with a residual distortion much less than .01%. The Sound Technology 1700A meets this requirement—its rated residual distortion is less than .002%, and it nulls automatically.

The model 1700A consists of an ultra-low distortion oscillator and a harmonic distortion analyser installed in the one case. The tunable notch filter of the analyser is ganged to the oscillator by the large bank of push-buttons on the front panel. Automatic nulling circuitry fine tunes the notch filter and assures maximum null of the fundamental. Any signal remaining at the output of the

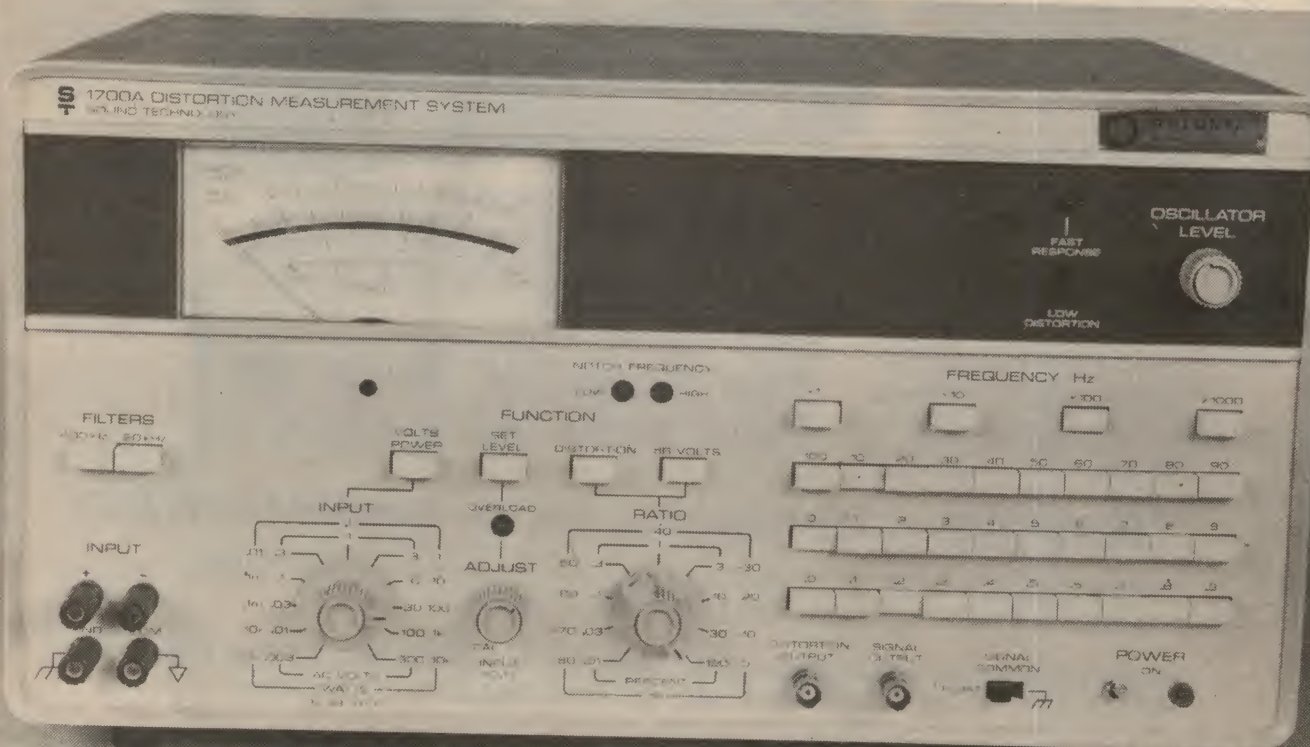
notch filter consists of distortion products and noise. This is displayed by the average-reading meter and the ratio of distortion to fundamental is indicated in either percentage or decibels. Switchable active filters are provided to remove hum and noise below 400Hz and high frequency noise above 80kHz. The distortion product waveform can also be fed to an oscilloscope for visual inspection.

Other features of the 1700A include separate voltage and distortion range switches, with the meter scaled for power into an 8-ohm load, fundamental level monitoring without range changing and notch frequency LED indicators to enable the 1700A to be used for distortion measurements involving external frequency sources. The test set inputs are fully floating and the oscillator output can be floating or tied to chassis.

Dimensions of the 1700A are 437 x 220 x 305 mm (W x H x D) and weight is 7.3 kg.

The relatively large size of the 1700A is dictated more by the large number of controls on the front panel than by a mas-

(Continued on page 23)



RAMBLER

Starts you off on the right track.

The BDP-100 Turntable and the SA-8200 amplifier are two fine examples from the Rambler Range of Hi-fidelity audio equipment.

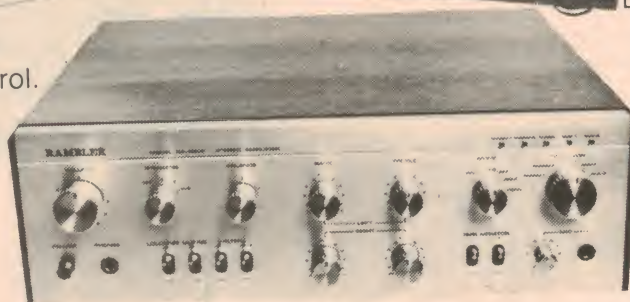
The BDP-100 2-speed turntable is quality engineering throughout, featuring a diecast platter, belt driven from a synchronous motor.

An "S"-shaped, low tracking error arm with adjustable anti-skate and lateral balance. Auto cut and return arm with independent dampened arm lifter. Magnetic cartridge with diamond elliptical stylus. Spring loaded detachable lid. Shock absorbing felt based feet. Sprung, heavy gauge metal motor board and wired ready for CD-4.

Channel it through our SA-8200 multi-purpose, stereo amplifier with its 55 watts RMS per channel output. Harmonic distortion of less than 0.2% at 45 watts RMS per channel. Inputs:— 2 phono, 2 AUX, 2 tape, tuner and mic. Separate base and treble controls on each channel. High and low filter switches and loudness control. Provision for 2 pairs of speakers. These are just some of the many value packed features in these two superb pieces of Rambler Hi-Fi equipment.



BDP100



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MR 160

SONY STR-7035

or 25 watts per channel into 4-ohm loads. Rated harmonic distortion is 0.8% and frequency response at 1 watt is quoted 30Hz to 40Hz at the -3dB points.

We measured power output at 28 watts per channel into 8 ohm loads and 16 watts per channel into 16 ohm loads. These figures varied only slightly depending on whether both channels were driven together or not.

For 4-ohm loads, power was 25 watts per channel with both channels driven and a relatively high 40 watts with one channel driven by itself. This means, in effect, that the available "music power" is about 80 watts total for 4-ohm loads.

Distortion measurements were considerably better than the 0.8% for rated power would indicate. In fact our worst measurement was a little over 0.2% and, for most of the time, our measurements were below 0.1% regardless of frequency (within the audible range) or power level.

Frequency response checked out exactly as specified. Separation between channels ranged from 36dB at 10kHz to 46dB at 100Hz. Phono sensitivity was 3.2mV at 1kHz while input overload at the same frequency was 50mV, which is adequate for most cartridges.

We were a little disappointed in the performance of the FM tuner section as

it did not appear to be quite up to the standard set by the rest of the receiver. We did verify that the sensitivity for 30dB signal-to-noise ratio for a mono signal was 1.7uV as quoted. But some other measurements were below spec—although not seriously so.

Harmonic distortion was quoted at 0.3% for 100% modulation on mono signals and we were able to measure it at 0.15%, which is good. By contrast, harmonic distortion for a 400Hz stereo signal 100% modulated is rated at 0.8% and we measured it at just over 1%.

Separation between channels was quoted at 35dB at 400Hz and we measured at 25dB in one direction and 22dB in the other. This may have been improved by a small adjustment.

During listening tests, the receiver performed very well. The only operating fault we noted was that the A + B position of the Speaker Selector did not appear to work.

To sum up, our overall impression of the STR-7035 is that it looks good and its amplifiers perform very well. But its FM multiplex tuner was a little disappointing and possibly would be much improved after a few adjustments.

Recommended retail prices are \$395 for the STR-7035 and \$349 for the STR-7025. Further information can be obtained from the Australian distributors for Sony equipment, Sony Kemtron Pty. Ltd., 469-475 Kent Street, Sydney, N.S.W., 2000. (L.D.S.).

SOUND TECHNOLOGY 1700A

sive amount of componentry inside. True, there is a fairly large bank of push-buttons wired into three PC boards, but most of the circuitry is accommodated on two large double-sided PC boards. These are mounted horizontally with lots of empty space above and below.

Considerable use is made of operational amplifiers and other integrated circuits to help minimise the component count. High quality components such as metal-glaze resistors and sealed trimpots are used throughout.

The oscillator circuit is basically a Wein bridge which has two operating modes: Low Distortion or Fast Response. The Low Distortion mode is used for distortion measurement while the Fast Response mode is used for frequency response testing where it is important that the envelope amplitude "settles" quickly. The latter mode results in moderately higher distortion.

Automatic null of the analyser notch filter is achieved electronically using phase detectors, floating integrators and photocouplers which control resistors in the phase-shifting and summing networks.

As anyone who has used a conventional manually-nulled distortion meter

could report, the 1700A is really a boon to use. It means the end of those fiddly adjustments to compensate for oscillator drift and the other changes that occur during prolonged testing. We understand that there is also an option of "automatic set level" which would greatly simplify distortion versus power measurements and similar repetitive testing.

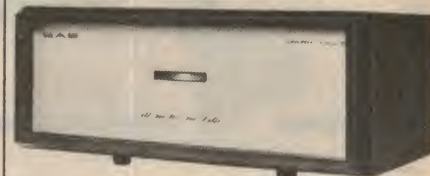
We must report that there is one irritating hassle with the 1700A and that concerns the unmetred oscillator output level. Surely it would have been a simple matter to provide an extra push-button to enable the output level to be monitored by the voltmeter circuitry. As it stands, the oscillator output must be coupled back into the meter inputs to enable the level to be measured, and this means disconnecting and connecting at least two cables.

Apart from the above small hassle, Sound Technology have certainly produced a really high performance instrument which would be a great asset in any audio design laboratory.

For further information regarding price and availability of Sound Technology equipment, contact the Australian distributors, Arlunya Pty Ltd, PO Box 113, Balwyn, Victoria, 3103. (L.D.S.)

TEST REPORT

"Newest SAE Amp is a Superb Job!"*



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RMS Harmonic Distortion—Guaranteed less than 0.1% at any power level or frequency, 20Hz—20kHz. Typical performance less than 0.025%. Absolutely no crossover notches at any level up to full power.

Frequency Response—1 watt: ± 0.25 dB 20Hz—20kHz. 50 watts: ± 0.25 dB 20Hz—20kHz.

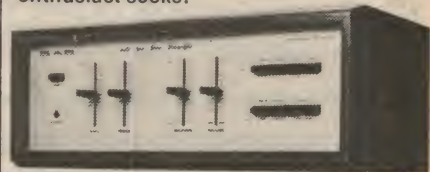
Signal-to-Noise Level—Guaranteed better than 100dB below 50 watts RMS.

*T.H.D. < 0.032% 20Hz to 20kHz.

Price: \$427

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Phono Inputs— ± 1 dB 20Hz to 20kHz.

RMS Harmonic Distortion—Less than 0.03% 20Hz to 20kHz at 2.5 volts. Typical Performance 0.015%.

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*EXTRACT OF Test Report from 'HIGH FIDELITY, MAY 1974'



News Highlights



Bell develops broadcast resolution CCD camera

Bell Telephone Laboratories engineers have built the first solid-state TV camera that meets the resolution requirements for commercial broadcast TV use.

The experimental camera, measuring only 2.5 x 2.5 x 6 inches, was built to demonstrate the feasibility of high resolution videotelephone systems. Its small size was made possible by the use of a solid-state imaging sensor, called a charge-coupled device (CCD), which was invented at Bell Labs in 1969.

The new CCD used in the camera contains nearly a quarter of a million sensing elements—a significant improvement in resolution over other known solid-state imagers. The imaging area of the new CCD was designed to be equivalent in size to the scanned area of a standard one inch-diameter vacuum imaging tube used in conventional TV cameras. It has 496 vertical interlaced scan lines and 475 horizontal picture elements.

CCD imagers consist, essentially, of a single chip of silicon covered with an array of electrodes. They do not require the high voltages, electron beam deflection, and vacuum envelope needed by conventional camera tubes. In fact, the complete solid-state camera occupies



the same volume as the camera tube and scanning coils in a conventional TV camera.

CCDs offer the possibility of performing electronic functions simply and inexpensively for a wide range of applications both within and outside the

telecommunications business. Bell Labs is exploring the possible use of CCDs in small TV cameras for future videotelephone systems, in time-delay and filtering circuits for telephone transmission, and in memory devices for use in electronic switching systems.

Digital watch prices set to tumble

Time is marching on, but the sounds of its progress may be getting fainter. If the recent history of the mushrooming popularity of the electronic calculator is any guide, then the electronic digital watch may soon silence the tick-tock coming from many wrists.

Right now, the prices for solid state digital watches range from under \$100 up to \$300, but as the production processes are made more economical the cost is expected to drop quickly, as it did for the electronic pocket calculator.

At least three companies along the peninsula just south of San Francisco, California (sometimes called Silicon Valley), are working together to bring prices down and yet maintain high reliability and accuracy. These companies include AMI (American Microsystems Inc.) of Santa Clara, and Varian Data Machines and Watkins, both of Palo Alto.

One new production process recently introduced at AMI, a leading manufac-

turer of electronic watch "works," is a high technology tester which tests the circuits that make up the watch's tiny computer. The completely solid state watch has no moving parts, and testing it is no small task considering the required accuracy is about five seconds a month compared with two minutes for most conventional watches.



The test equipment, called an ADATE tester, for Automatic Digital Assembly Test Equipment, is manufactured by the Watkins-Johnson Company. It is a high speed, dynamic tester which can be programmed according to which watch type is being tested. Over 180 tests incorporating some 5,400 measurements are executed in about four seconds.

A compact Varian computer "zaps" the micro-circuit with minute electrical pulses to test the three basic systems in the watch—the oscillating quartz crystal; the counting circuits which divide the oscillations into hours, minutes, and seconds; and the drives connecting the counters to the display.

AMI's first digital watch module, introduced more than a year ago, was about 360 mils thick, consumed 12 microamperes and required 6 volts to drive its timing circuits and display. In its newest modules, AMI engineers have reduced the thickness to 260 mils, the current to 7 microamperes and the voltage to about 3 volts.

—George E. Toles.

Apollo landings support Earth/Moon fission theory

Is the Moon a piece of Earth that broke away early in our planet's formation about 4½ billion years ago?

A paper prepared by Dr John A. O'Keefe of NASA's Goddard Space Flight Center, Greenbelt, Maryland, and Nobel prize winner Professor Harold C. Urey of the University of California, San Diego, suggests this fission theory of the Moon's formation should be seriously considered.

Using data gathered largely from the Apollo lunar landing missions and from earlier unmanned lunar flights, O'Keefe and Urey have found chemical evidence that the rocks of the Moon were once part of a mass which included a considerable portion of molten iron.

Lending support to the fission theory is the fact that the Earth has a much higher density than the Moon. This is due mainly to the fact that, as a proportion of total volume, the lunar core of molten metal is quite small as compared to Earth's.

Prior to the split, the iron in the Earth would have sunk towards the centre, drawing with it the gold, platinum and other noble (rare) metals found in the molten rock originally mixed with the iron. This accounts for the low density of the Moon, as well as its low content of noble metals.

Ion thruster engine developed by NASA

Payload gains of up to 20 percent in future NASA spacecraft are predicted as the result of the agency's development of an ion thruster engine. The ion electric thrust device would substitute electric propulsion for the chemical propulsion devices presently used for some spacecraft chores.

The ion engine is presently most attractive for station-keeping auxiliary propulsion on geosynchronous satellites. In addition, ion thruster propulsion provides encouraging new possibilities for mission planners, and can make a variety of new missions possible.

In the ion thruster propulsion system, the Sun provides energy which is converted into electric power by solar cells. This power is then tailored to the current and voltage needed by the ion thruster. Propellant (mercury, cesium or relatively stable gases) is ionized in the engine and electrically exhausted to produce thrust.

NASA's version of the ion engine now being tested at the agency's Lewis Research Center, Cleveland, Ohio, has become the first electric propulsion system to exceed 10,000 hours of operation, including 298 successful engine firings during that period. Lewis Center is continuing testing toward a new endurance goal of 15,000 hours.

Ocean temperatures may fuel generators

Electrical generating platforms that float beneath the ocean surface in a manner similar to icebergs may operate in the warm coastal waters before the end of this century. The pollution-free fuel used to spin the turbine-generators will come from the Sun's energy stored in the ocean surface.

Ocean Thermal Energy Conversion (OTEC), using temperature extremes of 20°C, is a feasible way to produce electricity according to a nine-month study conducted by Lockheed engineers under a National Science Foundation contract. OTEC could supplement the amount of electrical energy produced by existing plants to meet future increased demands.

The floating plants can be built from existing components, modified to meet OTEC requirements. They can produce electricity at a cost competitive with fossil-fuel plants. A demonstrator plant could be delivering electricity by 1985.

The OTEC closed-cycle concept involves heating a liquid until it becomes a gas which, under pressure, drives a tur-



bine hooked to a generator. Lockheed proposes to use ammonia as the working fluid. After passing through the turbine, the gas is cooled by water from the ocean depths until it becomes liquid and begins the cycle again.

US satellite to monitor ozone breakdown

A US scientist plans to use NASA's Orbiting Astronomical Observatory—OAO-3 (Copernicus)—to help ascertain the degree to which ozone is being broken down in the stratosphere, thus allowing additional ultraviolet light from the Sun to strike Earth directly. He is Dr Guenter R. Riegler of Bendix Aerospace Systems Division, Ann Arbor, Michigan.

The ozone layer in the stratosphere is a planetary cover which shields the Earth from most of the Sun's dangerous ultraviolet radiation. Concern has been expressed recently that chlorine—derived from aerosol spray cans—may be building up in the atmosphere to such an extent that it will begin breaking up the ozone layer in the stratosphere before the end of the decade. This would lead

to an increase in the incidence of skin cancer, and an increase in the average temperature of the Earth's atmosphere.

Using OAO-3, Dr Riegler plans to observe a bright star via the satellite's ultraviolet spectrometer to measure the amount of ultraviolet light absorbed at a particular wavelength—first when the star is high in the sky, and then as it sinks below the horizon. The readings will thus show the amount of chlorine naturally present in the star's spectrum as contrasted with the amount measured once it sinks below the horizon, at which time atmospheric effects should be apparent. By taking readings at regular time intervals for several years, Dr Riegler hopes to determine the rate of buildup of chlorine in the atmosphere, if any.

Flywheel-powered vehicles will cut fuel costs, says SRI

Stanford Research Institute (SRI) researchers are working on a device that they believe may replace gasoline for most urban driving within 15 years. The device is a flywheel—a wheel that stores up energy by continuing to rotate for some time after it is brought up to a speed.

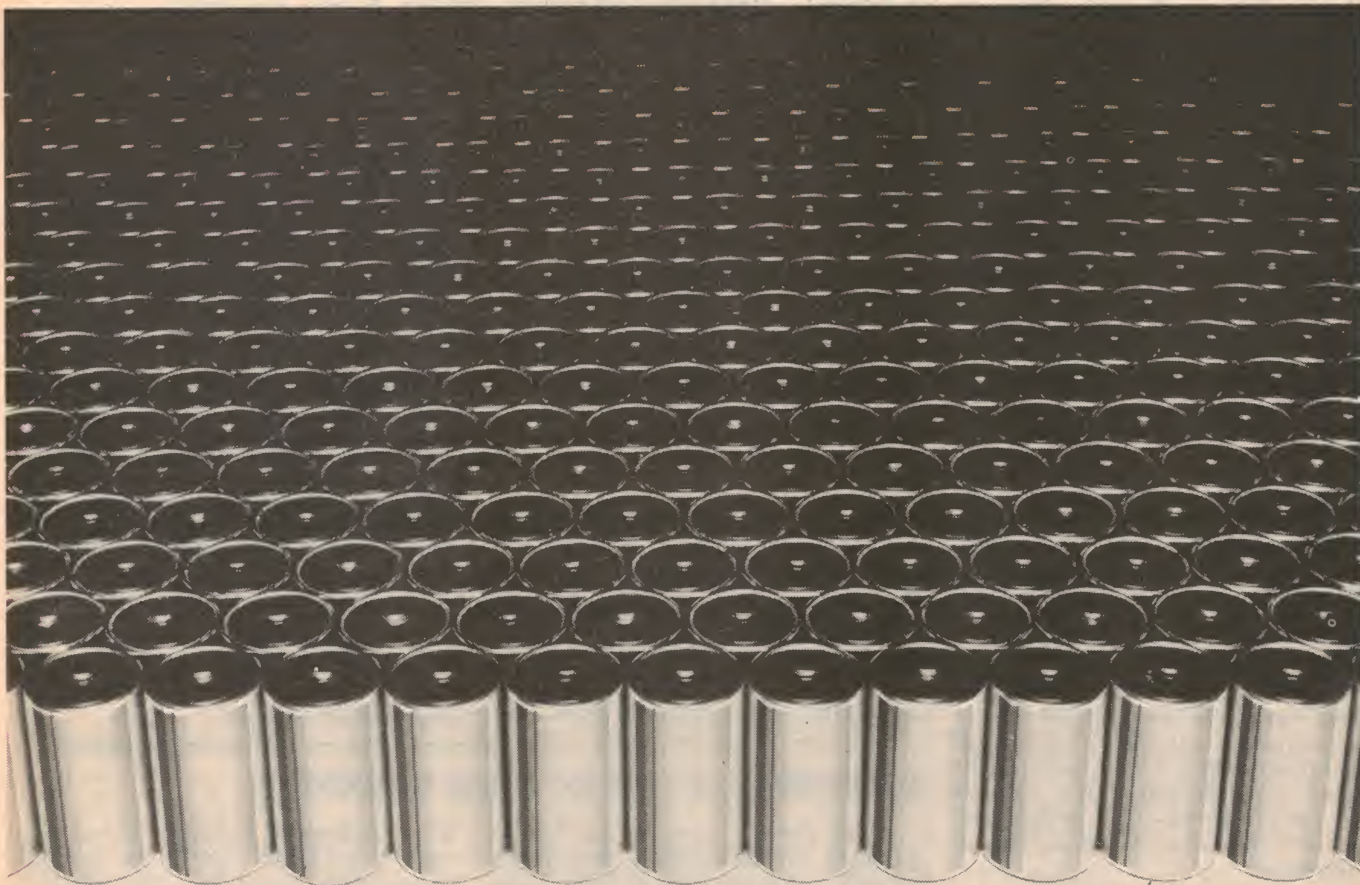
"It now appears we will be able to build a 350lb flywheel that can store enough energy to drive a Ford Pinto about 30 miles," says Peter M. Newgard, leader of the development team.

Mr Newgard believes that such a vehicle could be competitive in cost and performance with a conventional automobile. "Even at today's gasoline prices," he says, "it would cost no more

to buy and drive such an automobile than a conventional one. As gasoline prices continue to rise, a flywheel-powered vehicle will become comparatively less and less expensive."

Newgard visualizes a hybrid automobile powered by a flywheel and using a gasoline engine only to replenish the flywheel's spin on long journeys while the car is travelling at normal speeds. Normally, the flywheel would be brought up to speed with electricity while the car is parked overnight.

Since about three-fourths of all urban driving is accumulated in short hauls, such a hybrid system would greatly reduce gasoline consumption (and air pollution) in urban areas.



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NEWS HIGHLIGHTS

Computer generated models used in ear disease studies

An IBM scientist is using computerized analytical techniques to explore the nearly inaccessible inner ear and learn more about the hearing defects that originate there. He is Dr Alfred Inselberg of IBM's Scientific Center in Los Angeles.

Dr Inselberg's research is currently centred on developing a series of mathematical models that describe the complex function of the cochlea—the snail-shaped organ that contains the receptor cells of the brain's auditory nerve. These models are used in a joint study by IBM and the Ear Research Institute of Los Angeles into disturbances of the cochlea and associated hearing defects. Of particular interest is Meniere's disease, characterized by low frequency hearing loss, and by dizziness and nausea.

The research project is also providing clues as to the causes of presbycusis—the diminishing ability to discern high-pitched sounds as a person gets older.

Mathematical models are necessary for this type of work because the cochlea is so delicate that it may be destroyed by direct experimentation. However, considerable information does exist about the cochlea's physical structure and properties, and the physical laws that



Dr Alfred Inselberg of IBM, Los Angeles.

govern its dynamics are well known.

"Using this knowledge, it's possible to formulate a mathematical model that describes the function of the cochlea in a series of complex equations," Dr Inselberg says. "Then we generate a computer model, based on the solution to these equations, and we can perform experiments on the computer that can not be done on the cochlea itself."

Dr Inselberg has so far developed three models of the cochlea, each more complex than the last, and he is currently preparing a fourth. Using an IBM System/370 Model 145, he experimentally alters the properties of the computer model to investigate the relationship between the organ's physical structure and its functions.

"We are learning how different parts of the cochlea affect various hearing qualities," he says. "By isolating hearing defects in terms of these qualities, we hope to pinpoint the most likely internal cause."

For example, Dr Inselberg's experiments show that the ear's high frequency threshold is determined by the properties of the cochlea fluid, such as viscosity, and the stiffness of the membrane.

"We know that people lose the ability to hear higher frequencies as they age," Dr Inselberg says. "This could be caused by stiffening of the membrane as part of the aging process that also makes the bones harder and more brittle. In theory—and so far only in theory—the changes in membrane stiffness could be compensated by changing the viscosity of the fluid around it."

Infrared sensors for firefighting helicopters

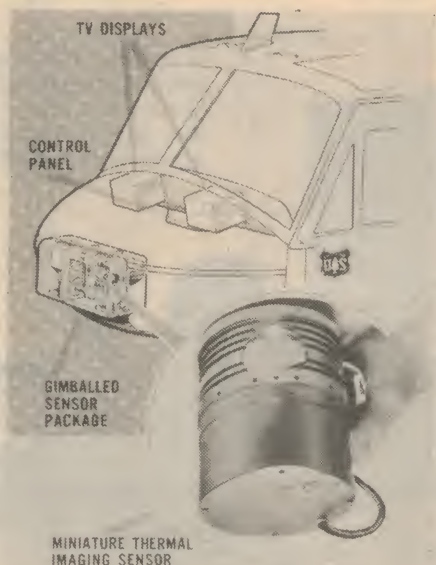
A new infrared sensor and imaging system that will enable helicopter crews to "see" through darkness, haze and smoke is undergoing flight tests with the Los Angeles County Fire Department, in cooperation with the US Forest Service.

The new infrared system was designed and built by Aeronutronic Ford Corporation, Newport Beach, California, and contracted through The Aerospace Corporation, Los Angeles, for the US Forest Service. It is intended to expand the useful role of helicopters in bushland fire suppression to both night and day operation.

The new thermal imaging system will be evaluated as a surveillance and navigation aid, and will provide the Los Angeles County helicopter crews with information on terrain features and other obstacles which may otherwise be invisible because of darkness or poor visibility.

The complete system consists of an infrared sensor/scanner, a cooling unit, gimbals to provide pointing of the sensor, associated electronics and television display units.

The sensor system will be installed in the nose bay of Los Angeles County's Bell 204-B helicopter, with the control panel



and two eight inch television display units mounted in the cockpit.

In operation, terrain information from the scanning infrared sensor will be sent to a detector/electronics module, immediately processed, and visually displayed on the television screens in the cockpit for "real time" instantaneous viewing by the helicopter crew. This information can also be recorded on video tape.

—George E. Toles

Miniature TV camera for advanced space missions

RCA is developing a tubeless television camera—potentially no larger than a pack of cigarettes—for possible use in NASA's advanced space missions.

The prototype black-and-white camera will employ a charge-coupled device (CCD) as the image sensor and will be designed under a \$US90,000 contract from the NASA Lyndon B. Johnson Space Center, Houston, Texas.

The CCD will make possible an ultra-small, lightweight camera capable of operating in space on very low power, according to Bert Soltoff, Program Manager for RCA's Astro-Electronics Division, Princeton, New Jersey, where the work is being done. The one planned for use in the space camera is a 512 x 320 element device.

In describing the space camera design, Mr Soltoff noted that conventional TV equipment at times cannot be used for certain space mission applications because of size, weight and power consumption limitations of the spacecraft.

Mr Soltoff said a scanning technique will be developed for the space camera that will assure its compatibility with the 525-line standard of broadcast television. This will make it possible to operate the camera with current US TV equipment.

Computers updating business management:

Workshop computers for

The computer revolution has begun, and before long "workshop" computers will extend their domain beyond the realm of the present day computer specialist and into the offices of executives and other professional workers. Coupled with this revolution will be increased business efficiency and profound technological and social change.

For 12 years, Douglas Engelbart, Director of the Stanford Research Institute (SRI) Augmentation Research Center, and his colleagues have been developing a prototype coordinated "workshop" of computer tools to augment the capabilities of professional workers in the same way that drills, lathes, grinders and milling machines augment the capabilities of machinists.

The professionals whose capabilities Engelbart seeks to augment include all

those whom Peter Drucker refers to as "knowledge workers"—that is, executives, planners, researchers, designers, writers and others who create and apply knowledge to productive ends. In fact, Engelbart intends his system to serve the secretary as well as the boss and all his colleagues and assistants.

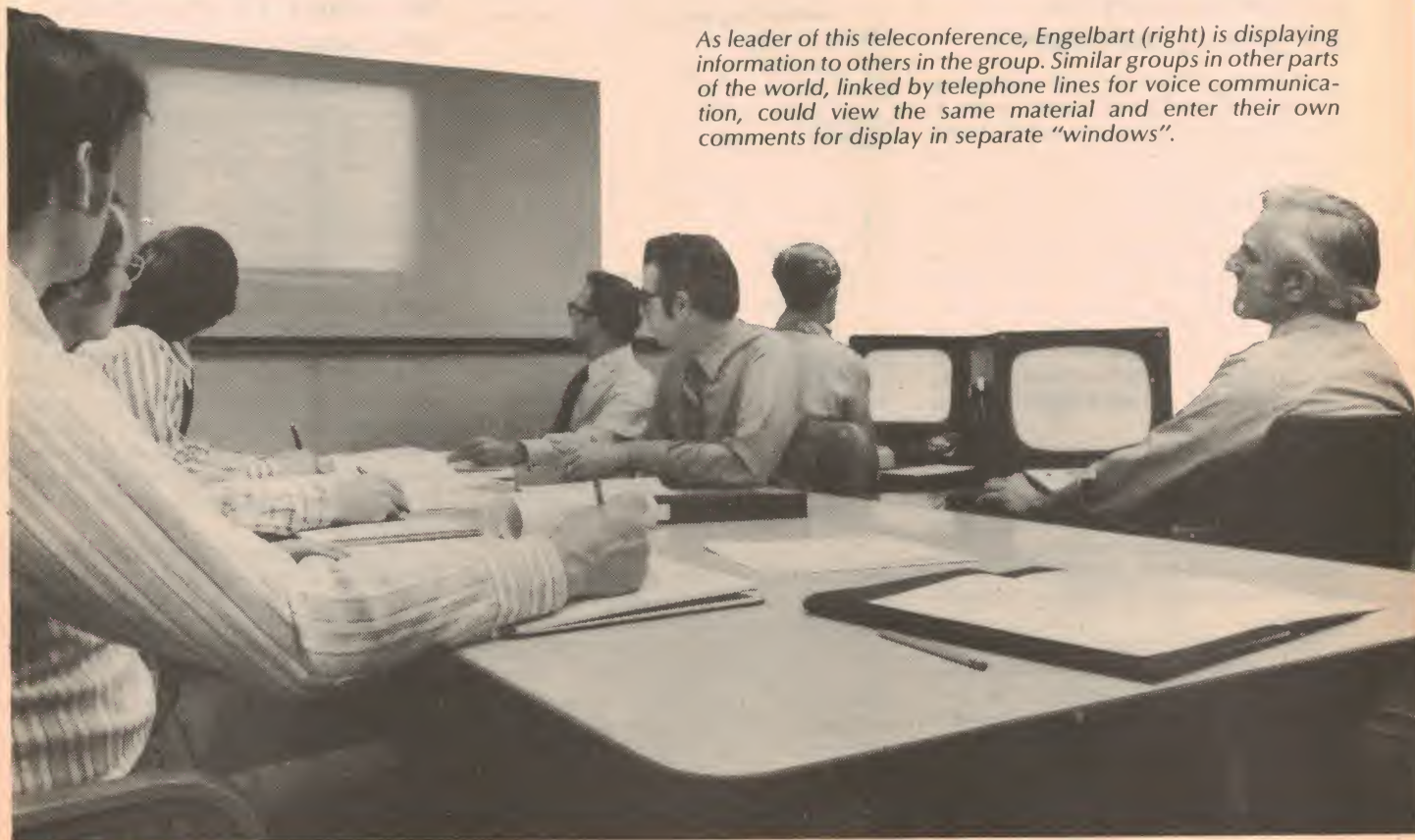
The visible tools include an electronic screen and a typewriter keyboard, plus two additional hand controls. One is a tracking instrument, which he calls a

"mouse," used to point to a spot on the screen and make simple commands to the computer. The other is a 5-finger keyset to supplement the typewriter-like keyboard for high speed execution of detailed operations.

The invisible tools of the workshop include all the computer hardware, software and communication networks needed to serve the daily handling of the users' working information—their notes, memos, letters, designs, plans, budgets, announcements, commentary, proposals, reports, documentary, item-control catalogues, etc.

These tools are linked together in a flexible modular format that makes it easy to add new tools as they become available or needed, and to link the sys-

As leader of this teleconference, Engelbart (right) is displaying information to others in the group. Similar groups in other parts of the world, linked by telephone lines for voice communication, could view the same material and enter their own comments for display in separate "windows".



tomorrow's executives

tem with other computer research centres in the ARPANET. This is a computer network that was built under the sponsorship of the Advanced Research Projects Agency (ARPA) of the Department of Defence, and interconnects computers all over the world into a single network.

The individual worker can use the workshop to draft and send memos, letters, documents, etc. The system then gathers together such material from all the members of an entire project team (who may be distributed throughout the country or even the world and connected only by the ARPANET), and organises this material into a comprehensive data base or library. All the collaborative dialogue that takes place

among the team members over a period of months or years may be included in this library.

By a simple command to his own desk-side terminal, each team member can call up any part of this dialogue on his screen, modify it, make notes in the margin, index it, send it to another team member, or cross reference it in a memo on his own.

When the recipient of the memo comes across that reference in the memo, he can command the computer to change the display quickly to show the item referenced in whole or in part, and then return to the memo. Or he can divide his display into separate windows so that he can view each simultaneously.

The system allows the user to scan through messages and reports in a variety of ways. For example, he can command it to display just the chapter titles or just the main paragraphs. He can then point at items in the middle of this list and make the computer show some sublist such as the first sentence or the first two sentences of each paragraph. Or if he instructs the computer to "jump to content," he can then type in a phrase or a word and the computer will show him where that phrase appears in the report and what words appear immediately before and after it.

James C. Norton, Assistant Director of the Augmentation Research Center, points out that these sophisticated tools actually change the way users think.

Typically, he says, writers who have never used the system organise at most the main points of a document, letting their thoughts on each point flow freely and sending the result to the typist. Not surprisingly, they often continue to make changes up to and including costly final stages of production.

The workshop tools allow users to rearrange words and paragraphs easily, so they can organise the material as they go along, trying this paragraph up there, noting the effect and changing it back if need be. Often when they look at the structure of the draft in some of the new ways described above, areas of faulty organisation pop out at them.

When the report is completed to their satisfaction, they can have it printed out or even published in final form. Programs that control these operations are included in the workshop software.

In addition, the worker can use other programs not presently included in the workshop so long as they are available on the ARPANET and provided, of course, that he makes contractual arrangements with the owners on the programs. He might, for example, wish to work interactively with a program that would help him step by step in the preparation of drawings and other graphics for the report. Once he had the entry code, he could access such a



Here a typist is entering a report on a teletypewriter for storage on tape cassette. The text will be read into the computer during the off-peak hours, leaving prime computer time open for editing, composing and information management.

Texas Instruments

SR-50

slide-rule calculator

SR-51

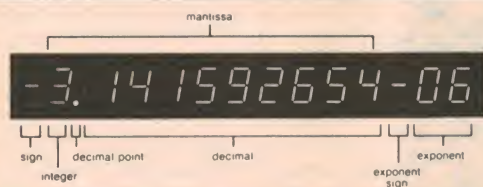
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feet	metres
yards	metres
miles	kilometres
miles	nautical miles
acres	square feet
fluid ounces	cubic centimetres
fluid ounces	litres
gallons	litres
ounces	grams
pounds	kilograms
short ton	metric tonne
BTU	calories, gram
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degrees	radians
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Workshop computers

remote program as easily as one included in the workshop.

Richard W. Watson, another assistant director of the Center, points out that for him and many other ARPANET users, their desktide computer terminals have largely replaced the US mails. To send a message to a colleague anywhere on the ARPANET, Watson types the recipient's name and organisation into the keyboard and follows with the message. This information is stored in his or the addressee's computer memory. The next time the addressee logs in at his terminal, he sees Watson's name and the subject of the memo displayed on his screen, along with all his other messages. If the message is urgent, Watson can instruct the computer to notify the recipient as soon as the message is delivered by putting a special flag on the recipient's screen.

Watson admits that he finds this system of communication preferable even to the telephone.

"I don't have to wait while the operator places the call," he explains, "or worry about time differences. And I don't have to interrupt the recipient. I know he will be logging in 3 or 4 times a day, so I can probably count on a response the same day."

One of the programs developed by the Center sorts Watson's mail for him, so that instead of reading through all the messages on the screen, he can query the computer about the nature of the messages. For example, he can ask it how many messages he has received, who they are from, whether they are over or under a certain length, etc. Then he can scan through the messages selectively in the manner described above for documents generally.

The availability of these computer tools on the ARPANET (and SRI is making



Here Engelbart is accessing the knowledge workshop from a computer terminal in his office. By moving the "mouse" (in his right hand) over a circular area to the right of the keyboard, he can position a pointer anywhere on the screen. Commands and short strings of text are entered via the 5-finger keyset in his left hand, and these can be confirmed or modified by pushing one or more of three buttons on top of the mouse. The bulk of the text is typed on the keyboard.

them available on an experimental basis to clients) encourages collaboration among workers in different branches of an organisation or in different organisations involved in the same project. Not only can they send messages to each other, but they can set up conferences in two or more locations so that groups can interact. This is of course a great saving in time and energy over physically travelling to a common conference room. Large display screens in each conference room (or smaller ones beside

each attendee, or both) can be linked so that an operator in any of the rooms (or each attendee himself) can control the visual material that is viewed simultaneously on all screens. This capability can be combined with two-way voice contact.

The implications of these capabilities for the business world in the last years of this century are obviously profound—as profound Engelbart believes, as the effects of railroads on the cottage industries of the 19th century. At one time, he

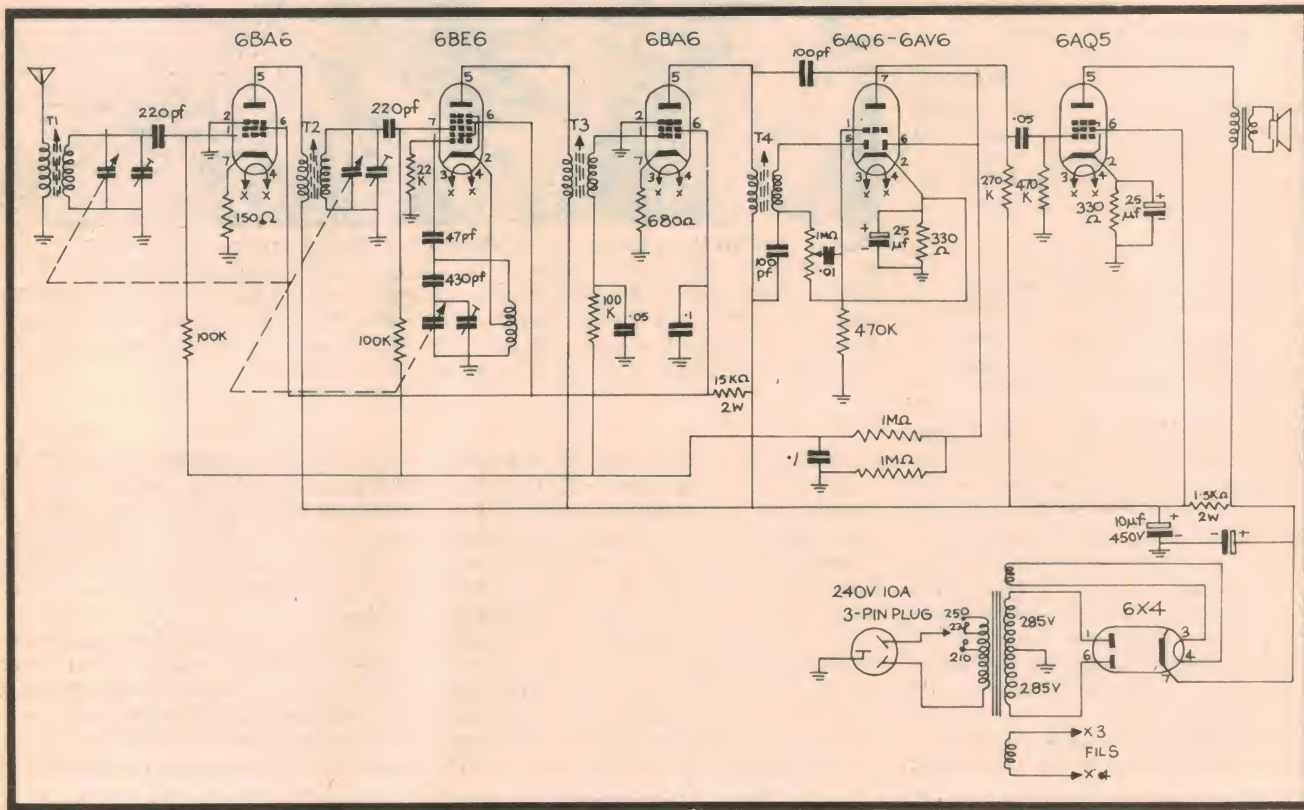


In this computerised word processing system, manufactured by Vydec, each typist is equipped with a large CRT screen capable of displaying an entire page of text.



This Data Products line printer produces hard copy of any material in the computer memory at a rate of six standard letter-size pages per minute.

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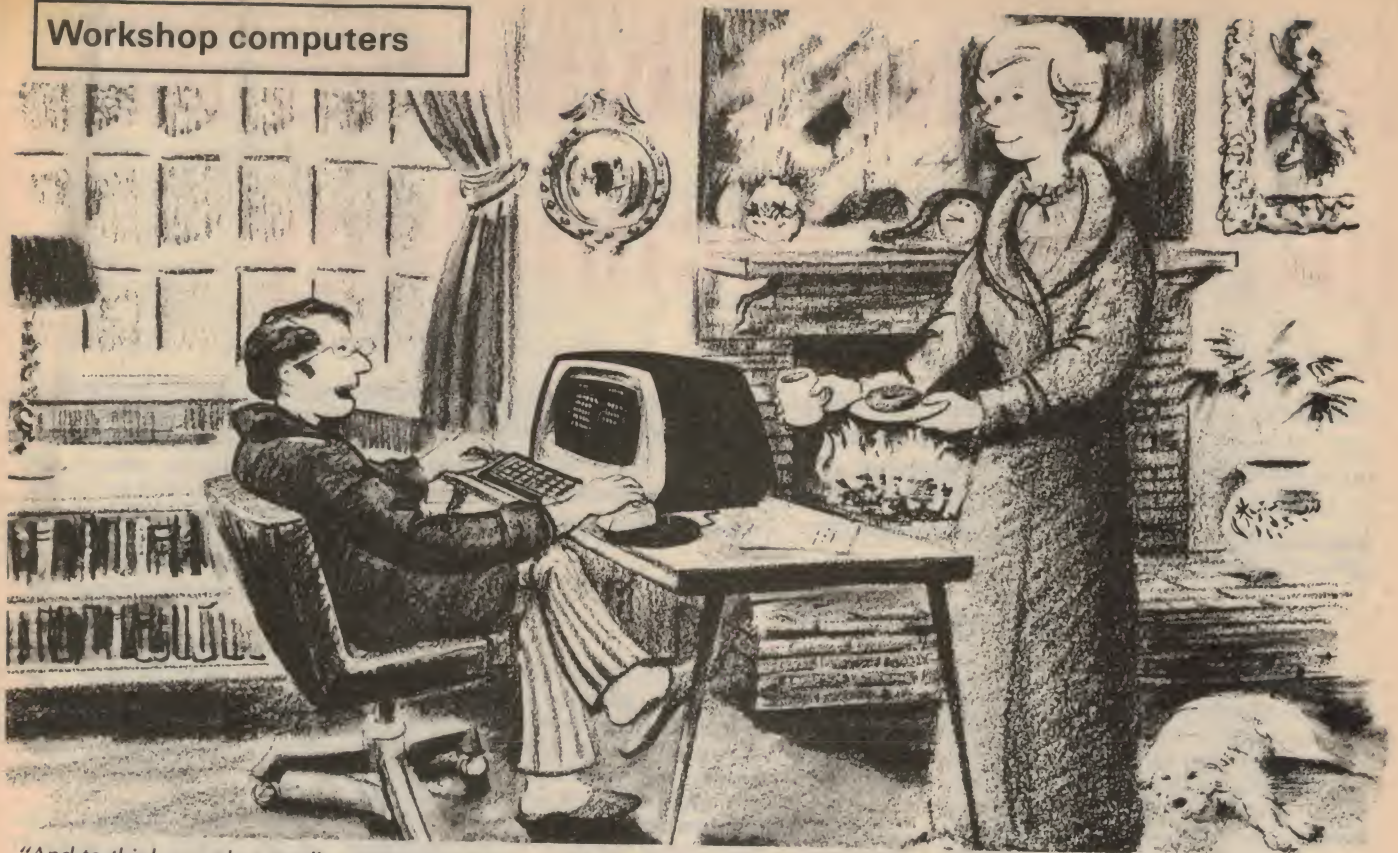
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Workshop computers



"And to think people actually used to travel to work!"

notes, every town had its artisans who supplied it with products that today are made at centralised factories and shipped throughout the world.

Engelbart expects a new computerised "marketplace" to evolve that will represent "fantastic wealth in the commodities of knowledge, service, information, processing, storage, etc. In the number and range of transactions, and in the speed and flexibility with which they are negotiated," he says, "this new market will have a vitality and dynamism as much greater than today's as today's is greater than the village market."

This computerised marketplace will encourage specialisation, he believes. Some individuals or small groups will provide libraries of information, all arranged for convenient use. Others will offer interactive programs specially tailored for particular types of analyses or for doing the text-graphic document typography in a special area of technical portrayal.

"Let's look at a specific 'for instance,'" says Engelbart. "Suppose that one person becomes extremely proficient in making small programs to generate a display or printout to show (particularly well) the status of a multi-task project. He is an independent agent in this multi-access computer network, working at a display console in his office at home. Perhaps he specialises in construction projects, and within this, perhaps, in steelwork erection.

"You are a management consultant working (from your home) on a short job helping to set up the production-control system for a construction project. When you realise that you might benefit from this kind of help, this is the sequence that takes place:

"Your man is easy enough to find because of computer help in searching for and evaluating special products and services. Suppose you need something he can do for you with about 45 minutes' effort. You expect immediate accessibility for negotiation. For instance: It takes you one minute to locate several candidates, two minutes to examine their relative credentials, 20 seconds for interrogation of public records to select him as being available right now for your kind of problem, two minutes of personal dialogue to determine for both of you that his capabilities and your needs match, and 15 seconds to negotiate and legalise a contract. He does his job in 40 minutes, and spends five more minutes transferring the results to you (with dialogue).

"He switches back immediately to a task sequence whose contract arrangement had permitted him such interruptions. In working on this job, you have been 'time-shared' with several other jobs having higher priority, and several that were running 'background'. During the forty minutes he was off doing his thing for you, your higher-priority task sequences took you off on other pur-

suits. In fact, when he was done, you weren't ready to get back to him for twenty-three minutes, but the mutual-scheduling algorithm agreed upon in your contract took care of connecting you and him, when you were both ready for your final dialogue."

Obviously there will have to be brokers, wholesalers, middlemen, retailers and bankers to make this computerised marketplace a working reality. And there will be a need for procedures and systems to assure privacy.

But Stuart Mathison, Vice President of Planning for Telenet, which is constructing a commercial network similar to the ARPANET, points out that long before all the mechanics of a computer marketplace can be worked out, there will be many uses for a commercial net. He expects the Telenet to be particularly attractive for interactive modes of communication with the computer—such applications as timesharing and order entry, or credit checking at the point of sale. It will also be attractive, he believes, for batch processing—the transmission of continuous streams of information such as large files on tape or cards—but only for long distances. For distances under about 500 to 1000 miles, he says, the leased line will probably be more economic than the Telenet for the next few years.

Reprinted from "Investments in Tomorrow," by arrangement with Stanford Research Institute.

Impressive advances in ultrasonic technology

Ultrasonic equipment ranging from straightforward industrial cleaning units to complex scanning machines for use in medical diagnosis went on show at the Ultrasonics International 75 conference held recently in London. Designed to demonstrate the practical applications of ultrasonic equipment, the show attracted contributions from some 15 different countries.

by **LEN STARNES**

In March 1973 the largest exhibition of ultrasonic equipment ever held in Europe was opened at Imperial College, London. During three days its 30 stands displayed equipment from Britain, America, Continental Europe, Asia and Japan and attracted over 1000 visitors. The exhibition formed part of a larger international conference—Ultrasonics International 73—devoted to the science and technology of ultrasonics and was the first of a series now to be held every two years.

It was against this background that the second conference—Ultrasonics International 75—was held recently in London. Again held at Imperial College, the conference program included some 64 papers from 15 countries and covered such topics on ultrasonics as high-power

applications, non-destructive testing, visualisation techniques, physical ultrasonics, signal processing, transducers and arrays, medical and biological applications, and underwater ultrasonics.

As before, the emphasis was on the practical applications of ultrasonics, the equipment displayed ranging from industrial cleaning units to complex scanning machines for use in medical diagnosis. Some of this new equipment is described in this article.

One of the fastest-growing applications of ultrasonics is medical diagnosis. Ultrasonic diagnostic techniques now offer many advantages over conventional X-ray examinations, besides being inherently safer. The market for machines capable of making routine hospital

examinations, for example in gynaecology and obstetrics, is enormous.

Among the British companies now firmly established in the design and production of such machines is Nuclear Enterprises, which displayed the most recent improvement to its award winning NE 4102 Disonograph ultrasonic scanner—the NE4104 greyscale storage display.

The new greyscale display offers clinicians the benefits of conventional storage tubes and, at the same time, a picture with the full range of grey shading. This greatly simplifies the acquisition and interpretation of pictures of more complex structures.

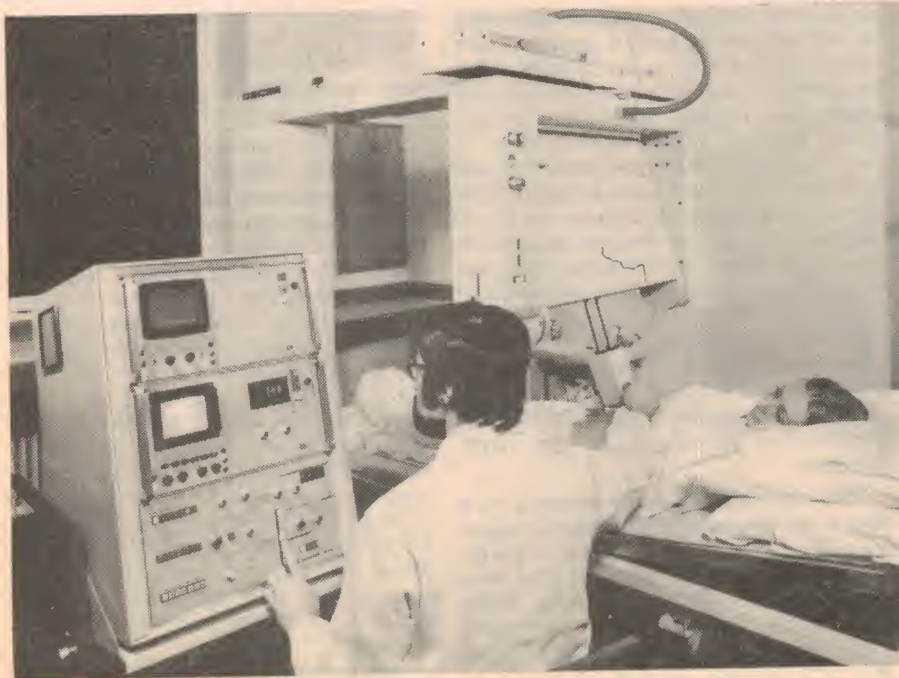
Ten observable shades of grey can be displayed on the screen for optimum tissue discrimination, while dynamic range compression and contrast-enhance circuitry allow echo amplitudes of interest to be spread across the grey scale of the display. Additional facilities include a time share, store/view facility which allows the operator to see the build-up of a picture during the scanning process. A magnification capability allows any area of interest to be selected and magnified to cover the screen.

Two new products using high-power ultrasonics were shown by Dawe Instruments, one of Britain's largest manufacturers of ultrasonic equipment. The first is the 7801A metal welder, designed for welding practically all metals but most effective with aluminium, copper and brass. Ultrasonic friction between the metal surfaces to be joined breaks up oxides and other contamination, and the exposed, clean surfaces are brought under pressure into intimate contact with each other. Solid-state bonding then takes place.

The process is characterised by low heat, low distortion and an inherent surface cleaning action due to the vibratory friction. As a rule, no surface preparation is required prior to welding.

Metal thickness ranging from 0.1 to 2.0mm, or 0.3 to 3.0mm in the case of wire, can be accommodated and typical welding times are short—in the order of a few seconds. All connections are lap welds and it is normally possible to weld through layers of insulation material.

The second new product displayed by Dawe Instruments was the Dawe 7700-series fluxless ultrasonic soldering system. This is capable of soldering and



A patient undergoing a routine obstetric examination on the Disonograph NE 4102 ultrasonic scanner at Queen Mother's Hospital, Glasgow, Scotland.

tinning aluminium, tin, brass, copper, beryllium copper, nickel and other non-ferrous metals. Three models are available and a typical system consists of a power supply, converter and solder tank.

The power supply delivers 20kHz coustic energy to the lead zirconate titanate transducer and alloy horn located in the solder tank where it produces cavitation in the molten solder. The cavitation action erodes oxides from the surface to be soldered and the solder metallurgically bonds the bare metal without use of flux or any other cleaning agent.

Plessey Marine Division, which produces a wide range of underwater sonar equipment, displayed a sonar beacon for use on ships, aircraft and offshore oil drilling rigs and production platforms. Originally developed for Royal Navy helicopters, the beacon activates on contact with water (at about 1 metre depth) thus making search and location easier and faster.

Range is about 9km over 360 degrees. The replaceable and encapsulated mercury battery lasts for approximately 10 days. Operating frequency is 9.5kHz, the same as that used by military and commercial sonar-sweep equipment, with a pulse width of 14 microseconds at a pulse-repetition-frequency from continuous to one every five seconds.

Non-destructive testing is one of the largest applications of ultrasonics. At least two companies, Terratest and Sonatest, are active in this field, and both companies showed their latest flaw detection equipment.

Terratest has produced an improved version of the BT-2 materials tester, designed for quality control of concrete, refractories, cast-iron and many other materials. The up-dated instrument, designated BT22, has a wider range of frequencies (10kHz to 1MHz) and features modular circuit construction. Transit times through specimens can be measured to within 0.1 microseconds, the time being displayed on five 7-digit light-emitting-diode windows.

Sonatest's flaw detector is the UFD1, a sophisticated general-purpose instrument operated from either mains or 12V direct-current battery supply. Special facilities include a calibrated attenuator two-channel monitor, with calibrated delay, swept-gain, and interface trigger circuit. Operating frequency is 0.5 to 15MHz in six switched bands and range is from 5mm to 8 metres in steel. The display is on a 100 x 80mm high-brilliance screen with non-parallel graticule.

Although the foregoing has only briefly described just five examples of the equipment exhibited, it should provide the reader some insight into the impressive advances now being made with ultrasonic technology. In summary, it is apparent that ultrasonics has important contributions to offer in medicine, underwater communications, and a wide range of industrial processes.

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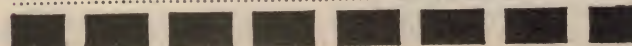
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Experimental 10GHz link using PWM & a Gunn diode

Although mainly intended for doppler radar and ranging, the new Gunn diode microwave transceiver modules can also be used for radio communication. In this article the author describes a simple communication system using pulse-width modulation, and suggests how the idea could be developed further.

by JAMIESON ROWE

When we were processing Philip Tracy's article on the Philips 10GHz Gunn diode modules, published in the May issue, it occurred to me that these modules could be of interest to radio amateurs. It seemed possible that they might be used to form the heart of a simple low-power telephony link, which would be practical and at the same time give worthwhile experience with both Gunn diodes and microwave aerials.

I mentioned the idea to Philip Tracy, and he agreed that it seemed worth following up. However, he warned that simple AM would probably not be practical, as Gunn diodes tend to operate properly and reliably only within a fairly narrow range in terminal voltage. At the same time he kindly arranged for Philips Elcoma to make available a sample module, to experiment with.

At the earliest opportunity after the arrival of the sample module, I looked through the Gunn diode literature in search of inspiration. The first thing that suggested itself was that although the characteristics of the device would not allow anything like 100% AM by simple modulation of the current, it might be possible to achieve low-depth AM by swinging the voltage by 10% or so either side of the nominal 7V DC.

The simplest way to try this seemed to be by connecting the low impedance secondary of an audio transformer in series with one of the diode supply leads, with the transformer primary fed from an audio generator. However, when I tried this, the immediate result was that the Gunn diode promptly expired! Apparently Gunn diodes do not like voltage transients, and the transformer must have produced such a transient at the instant of switch-on.

I had learnt one thing from this initial foray into Gunn diode communication, then: simple transformer modulation was out. Unfortunately my Gunn diode was also "out", preventing further experiments at least for a while.

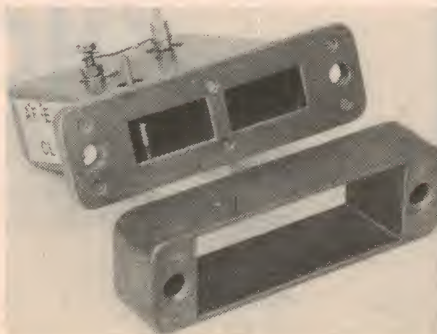
After the initial embarrassment had worn off, I contacted Philips Elcoma once more and let them know what had

happened. They were quite happy to provide a replacement module, but suggested that before we went much further, it might be a good idea if they found out if the modules could be supplied pre-set to a frequency within the 10GHz amateur band: from 10.00 to 10.50GHz. We let the matter rest while they followed this up.

In the meantime, I learned that another similar 10GHz Gunn diode transceiver module had been made available, by Associated Controls Pty Ltd of 55 Fairford Road, Padstow, 2211. Selling for a similar price to the Elcoma module, it appeared to be equally suitable for amateur radio work; in fact they had already done some work along these lines. I spoke to George Hodgson, VK2OH, who was happy to co-operate by offering a couple of sample modules, technical data and advice regarding the results they had already obtained.

As a result of this I was able to press ahead once again, and decided to follow up another idea: pulse-width modulation (PWM). This seemed likely to give good results with the Gunn diode, as it would only involve the diode being switched on and off—for varying proportions of the time. At the same time it would be straightforward as far as reception was concerned, because it could be detected in virtually the same way as for normal AM.

The idea is rather like the "class D"



At left is the Philips CL8966 transceiver module, with the Associated Controls module to the right. Both appear suitable for the system described.

audio amplifiers which claim attention from time to time. The main microwave carrier is modulated by a supersonic subcarrier, which in the absence of audio has a square waveform; the carrier is chopped into a string of short bursts, separated by gaps of the same duration.

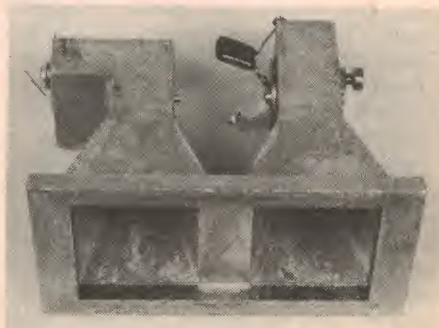
The desired audio modulation is used to vary the mark-space ratio, or the "duty cycle" of the supersonic subcarrier. During the positive audio half-cycles, the carrier bursts increase in length, while the gaps between them shorten. The opposite occurs during negative audio half-cycles. As a result, the audio has the desired effect of varying the effective amplitude of the main carrier.

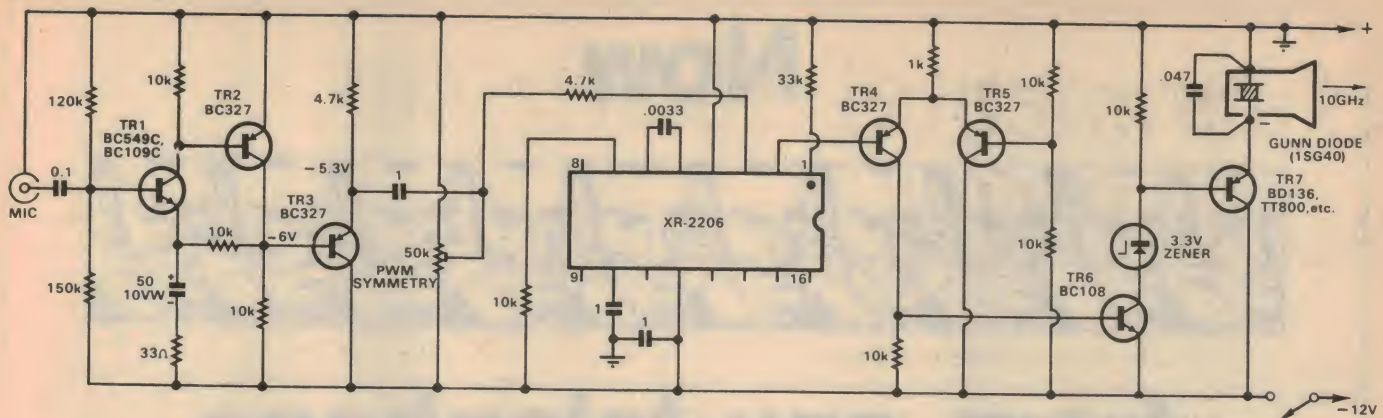
Of course the supersonic subcarrier effectively "samples" the audio, so that from sampling theory it must have a frequency of more than double the desired audio bandwidth. And as it is in the form of a rectangular wave, with rapid transitions, the actual bandwidth of the modulated 10GHz carrier will be quite wide—between 200 and 300kHz if the subcarrier is at 20kHz.

This would make the PWM system quite unacceptable at lower frequencies, of course. But as the 10GHz amateur band is 500MHz wide, and we're only talking about a radiated power of about 10 milliwatts, it is quite practical for the present purpose.

Well, to cut a long story short, I have been able to develop a simple PWM system which appears to work quite well with the Gunn modules. In tests with two of the Associated Controls modules, using only the integral 12dB horns, I was able to establish contact over a range of about 300 metres quite easily—a figure set mainly by operating convenience.

With supplementary horns or parabolic dishes to give considerably





10GHz PWM TRANSMITTER

Here is the circuit for the experimental PWM transmitter, based on a function generator IC. The change suggested for Philips modules is shown at right.

greater aerial gain, it should be possible to extend the range to much more than this modest result. There's plenty of room for further experimenting, in other words.

At this stage I haven't been able to verify that the system will also work satisfactorily with the Philips modules, as these have not yet turned up. However, Philips have advised that they will be making available modules accurately pre-tuned to 10.450GHz, for amateur use. From the technical data it seems likely that these units will be electrically almost identical to the Associated Controls modules, so that they should be equally suitable. The modules will be available on order through your usual supplier, as also will be the Associated Controls modules. The type number for ordering will be CL8966.

The main difference between the two types is that the aerial horn supplied with the Philips module has a gain of 5dB, somewhat lower than that of the horns integral with the Associated Controls module. It also has a slightly lower output power, typically 8mW compared with 13mW. On the other hand the Philips modules will be pre-tuned to a guaranteed frequency within the amateur band, whereas you will have to tune the Associated Controls modules yourself. More about this anon...

As you can see from the diagrams, the experimental PWM system uses quite straightforward circuitry. The heart of the

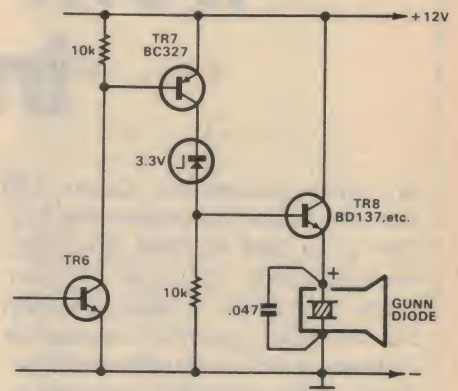
transmitter circuit is a function generator IC, the Exar XR-2206, available from A. J. Ferguson Pty Ltd. This is connected to produce a triangular wave output from pin 2, at a frequency of around 20kHz (determined by the 10k resistor and .0033μF capacitor).

Pin 3 of the IC is an input controlling the DC level of the output triangular wave, and this is used to achieve the desired modulation. Transistors T1 and T2 are used as a simple mic preamp, driving pin 3 of the IC via emitter follower T3. This gives a low impedance source, and also serves to prevent supersonic signal from feeding back into the mic preamp.

A 50k pot across the 12V supply is used to adjust the DC level at pin 3, along with the audio. The output from pin 2 of the IC is thus a 20kHz triangular wave whose average level is set by the pot, but with the audio wobbling it up and down on an instantaneous basis.

This triangular wave is then fed to transistor T4, which with T5 forms a simple threshold sensing switch or comparator. In effect, the triangular waveform is compared with the fixed DC level at the base of T5, and transistor T4 is switched on and off depending on their relative levels. It is switched on when the triangular wave is the more negative, and switched off when the base of T5 is the more negative.

With no audio present, this on-off switching can be adjusted to a 1:1 ratio



TRANSMITTER MODIFICATION FOR PHILIPS MODULE

by means of the 50k pot, giving a symmetrical square wave at the collector of T4. Thus when the audio swings the triangular wave up and down, it is able to swing the mark-space ratio of the switching waveform symmetrically either way from this 1:1 level. Hence the reason for labelling the 50k pot "PWM symmetry".

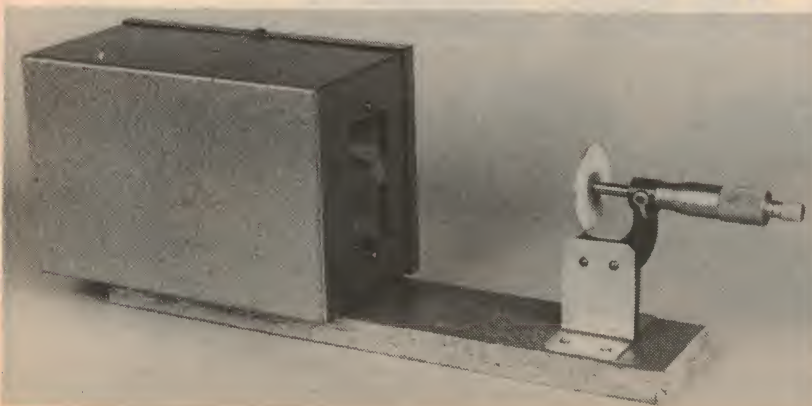
You can see from this, I hope, that the signal at the collector of T4 is our required PWM subcarrier. This is then squared up by transistor T6, and then fed to the Gunn diode via emitter follower T7. The emitter follower provides a low impedance driving source, which is needed both to supply the Gunn diode current (around 200mA) and to ensure that the diode operates in a stable fashion. The .047μF capacitor across the Gunn diode is also for stability, and it must be wired right at the diode terminals.

The 3.3V zener diode coupling T6 to T7 is used as a DC level shifter, to limit the Gunn diode voltage to within its ratings.

By the way, the positive supply grounding arrangement is used because the positive side of the Gunn diode is connected to the casting of the Associated Controls module. The opposite arrangement will be necessary with the Philips modules, however, as these have the negative side of the Gunn diode connected to the casting.

In fact with the Philips modules you

One of the experimental transceivers with the simple micrometer wavemeter described.



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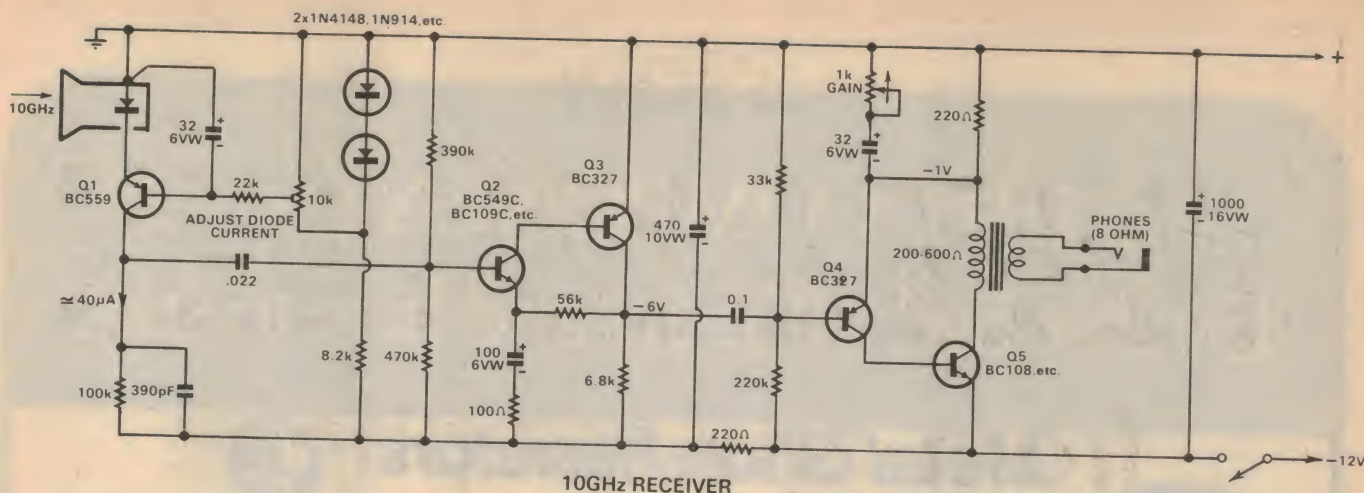


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The receiver circuit, which is basically an amplified crystal set. The suggested change for Philips modules is shown at right.

will have to drive the Gunn diode via an NPN emitter follower, as well as reversing the supply grounding. This will involve an extra transistor, as shown in the small diagram.

The receiver side of the system is quite straightforward, being essentially an amplified "crystal set". The diode in the receiver cavity of the module is used as a straight detector, with the rest of the circuit used to amplify the resulting low-level audio. The amplified audio is used to drive a pair of 8-ohm phones via a small step-down transformer.

Transistor Q1 is used as a low-noise preamp, connected as a common-base stage. At the same time, it acts as a DC emitter-follower, providing bias current to the detector diode. This configuration is adapted from that used by Philip Tracy in the Doppler intruder alarm described in the May article.

The detector diode is supplied with DC bias as this improves its detection efficiency. As there is an optimum bias level, the bias is made adjustable. This is done by feeding the base of Q1 from a 10k preset pot connected across a couple of silicon diodes, which provide a stabilised source of around 1.2V.

The optimum bias current for the mixer diode will lie between about 10 and 100 μA , and typically seems to be at about 40 μA . If necessary, it can be monitored by means of a microammeter connected temporarily in series with the 100k collector load of Q1.

Note that the base of Q1 is bypassed directly back to the metal casting side of the detector diode, to avoid interference pickup. Thus the only input signal to Q1 should be the diode output, as far as AC is concerned.

The 390pF capacitor across the 100k load of Q1 is to provide integration of the detected PWM signal, to smooth it into fairly clean audio once more. The smoothed output is then amplified by Q2 and Q3, connected as a low parts-count feedback amplifier with a gain of 560. The amplified signal from Q3 is then fed to

the output stage, which uses Q4 and Q5 in a similar feedback configuration.

As the receiver was designed to drive a pair of 8-ohm phones, which need only a few tens of milliwatts, the output stage uses a BC108 or similar transistor. It runs at around 5mA, and is more than adequate for the job. The DC operating point is firmly stabilised by the negative feedback effect produced by the 220-ohm feedback resistor.

Coupling to the phones is via a small transistor output transformer, reflecting an impedance of between 200 and 600 ohms. I used one from an old transistor radio, with a primary impedance of around 400 ohms.

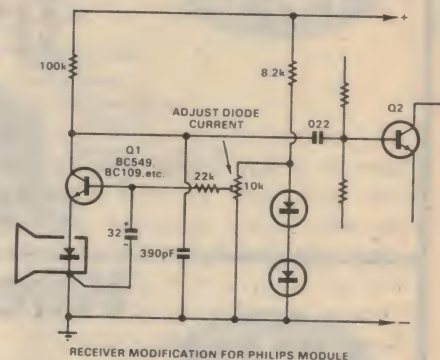
The audio gain of the receiver is adjustable over a reasonable range by means of the 1k pot, which varies the degree of negative AC feedback in the output stage.

Note that like the transmitter section, the receiver circuit uses an earthed positive rail. Again this is to suit the Associated Controls module, which has the anode of the detector diode earthed.

As before the Philips modules have the opposite arrangement, so that for a Philips module the negative rail will have to be earthed instead. At the same time an NPN transistor will have to be used for Q1, as shown in the small diagram.

As you can see, both the transmitter and receiver circuits are designed to run from 12V DC, so that they can be operated from either a mains power supply or from a common dry battery. If desired they can easily be fitted into a small utility case, like that shown in the picture, to form a portable transceiver.

There are a few points to bear in mind if you build up the system. One is to never try operating the Gunn diode without the .047uF capacitor across it. This can cause spurious oscillations due to interaction with the connecting leads. Also do not run the Gunn diode at a voltage between 2 and 6 volts, as this can cause over-dissipation and diode damage. Never apply reverse bias.



either. And avoid switching transients (!)

As far as the detector diode is concerned, the main point is never to allow diode current to exceed 1mA, even very briefly. Switching transients in the nanosecond region can cause damage, either completely destroying the diode or ruining its noise figure.

Incidentally, Associated Controls are able to supply replacement Gunn diodes and detector diodes, should you come to grief. Their module is also designed for user replacement of the two devices, whereas the Philips modules are not. A point to note is that the transmitter tuning depends upon the individual Gunn diode, so that it will alter if the diode is replaced.

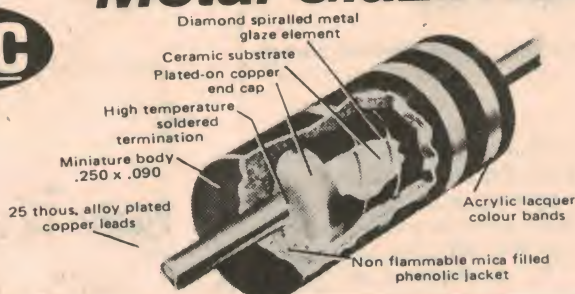
The final point concerns frequency measurement, to ensure that you are operating legally inside the 10.00–10.50GHz amateur band. This won't be a problem if you use the Philips modules, because these come pre-tuned to 10.450GHz. However with the Associated Controls modules the frequency will have to be set to within the band. For this you will obviously need to measure or at least check the frequency.

The situation is complicated somewhat because the tuning scheme used does not give constant oscillation efficiency at all frequencies. As a result the output tends to vary with tuning, going through a series of dips and peaks. The aim is therefore to set the tuning for one of the peaks within the amateur band, so that you are not only

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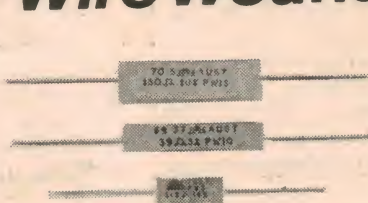
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10GHz PWM link

legal but also putting out as much power as possible. The actual tuning is carried out by means of the 4BA screw which protrudes from the transmitter cavity, between the Gunn diode mounting grub screw and the end wall. When the locknut is loosened, the screw is capable of shifting the frequency between about 10.3 and 10.7GHz.

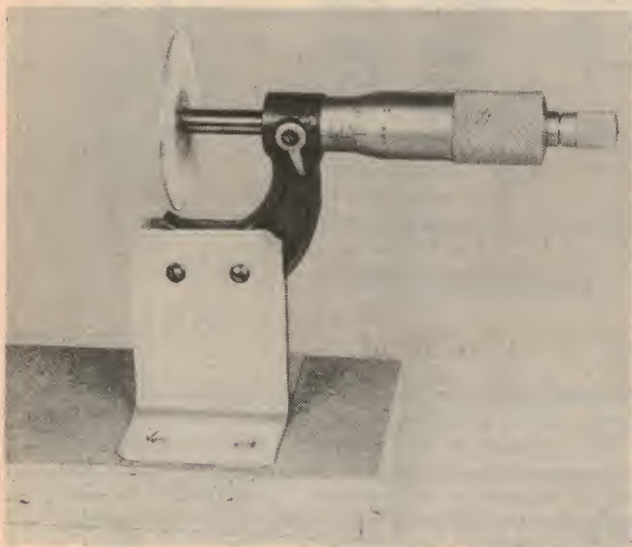
Note that the Philips modules are fitted with a similar tuning screw. But as these modules are accurately pre-tuned, in this case the screw should be left well alone.

One possibility for checking the frequency of one of the Associated Controls modules would be to find another

to a microammeter, and measuring the distance the plate must be moved to vary the current between two adjacent troughs, you can determine the half-wavelength and hence the frequency. Note that it is generally best to use the current troughs for the measurement, as they are more sharply defined.

The distance that the plate must be moved has to be measured quite accurately, as a half wavelength at 10GHz is only 15mm. The distance must be measured to considerably better than 1mm, which as an error corresponds to 333MHz. In fact you really have to achieve micrometer accuracy, with resolution to either .01mm or .001in. These correspond to errors of 3.33MHz and 8.46MHz respectively.

The obvious way to achieve this is to modify a low cost micrometer. These are



A close-up shot of the simple wavemeter which the author made by modifying a cheap micrometer. A flat disc of aluminium is cemented to the probe, after which the anvil jaw is cut away.

amateur with one of the Philips modules, and adjust yours until a zero beat is heard in one or other of the receivers. However this may not be easy, as finding zero beat at 10GHz is rather like looking for a needle in a haystack. There is also the problem that you still won't know if your unit is delivering its full output (10.450GHz may coincide with one of its dips, for example).

A better approach seems to be a simple wavemeter based on the principle of standing waves. The idea works rather like the "Lecher line" system used at UHF. If a metal plate is used to reflect the microwave energy back to the receiver cavity, a standing wave pattern is set up. The energy picked up by the receiver diode will depend upon the position of the metal plate, and if the plate is moved towards or away from the module, the detected current will vary cyclically, through a series of peaks and troughs.

In fact just as with a Lecher line, the distance the plate must be moved to vary the diode current through one peak-to-peak or trough-to-trough cycle is equal to one half wavelength. So that by connecting the detector diode temporarily

available in both metric and imperial versions, for around \$10 at the larger hardware stores.

As you can see from the photographs, I modified one by cementing a flat disc of 22 gauge aluminium sheet to the end of the probe with epoxy cement, using the micrometer itself as a clamp to hold the disc square while the cement was setting. Then with the cement completely set, the anvil jaw was hacksawed off, and the resulting unit mounted on a wooden base.

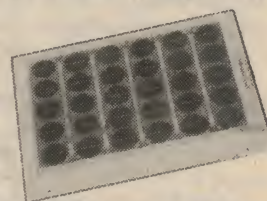
The wooden base must be long enough for the transmitter assembly to be mounted at the other end, so that it and the wavemeter are rigidly fixed with respect to each other. Otherwise, the readings you will get will be wildly in error, and useless.

There you have it, then. A simple 10GHz communication system, using the latest Gunn effect device and a novel PWM modulation system. It will be interesting to see how far you can push its modest 10mW or so of output, using either auxiliary horns or parabolic dishes. Even if it's only a few miles, I think you'll find it a rewarding challenge. Over to you!



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SPECIAL OFFER:

Transistors, diodes—20 for \$1

Here is an offer to gladden the hearts of experimenters, radio clubs, youth groups etc; PC208 (BC108) transistors and small signal germanium diodes for the equivalent of 5c each! To take advantage of this offer we have selected a number of past projects which used these devices extensively and we present them on these pages.

The offer comes from Dick Smith Wholesale Pty Ltd. Both the transistors and the diodes will be packaged in lots of 20 for \$1.00. This offer is intended primarily for "Electronics Australia" readers and, by way of identification, we strongly recommend that the coupon, which appears elsewhere on these pages, be presented with each order.

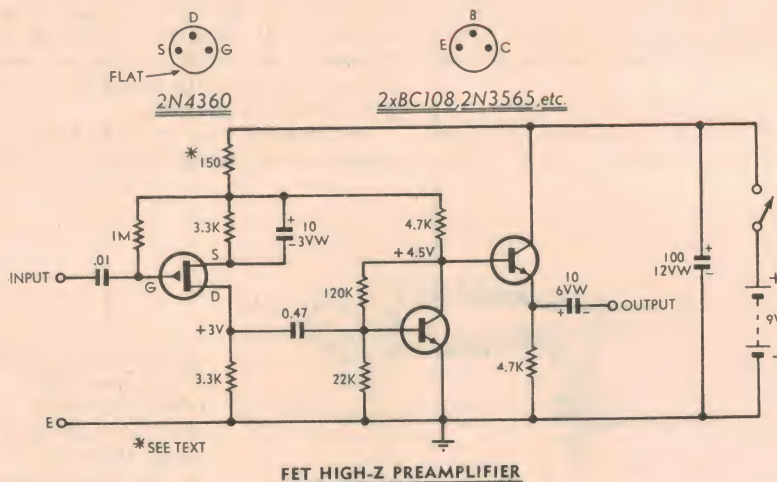
This price applies to over-the-counter customers. Mail order customers should add 50c per order to cover postage and packing.

The offer will remain open while stocks last, which is not expected to extend beyond the end of October, 1975.

Dick Smith emphasises that these devices are in no sense factory rejects or "seconds". Both are standard quality items which would be expected to meet all their manufacturer's specifications. (The transistors are by Fairchild.) The offer is simply because Dick Smith was able to purchase the surplus stock of a local TV manufacturer at a very keen price.

Electrically, the PC208 is virtually identical to the older and better known BC108. Physically, it is slightly different, being housed in the TO-92 encapsulation, rather than the metal can of the BC108. This has the effect of slightly reducing the maximum dissipation rating but this should not be of any importance in the suggested applications.

Some readers may be able to work directly from the circuits. Others may have access to the original articles. Alternatively, reprints are available through our "Information Service".

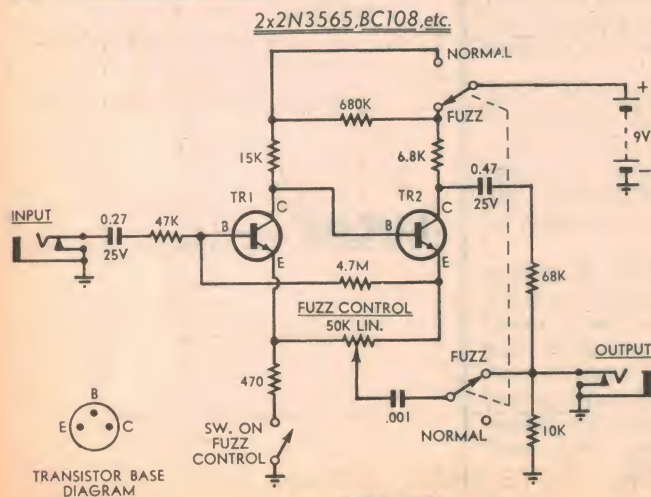


FET HIGH-Z PREAMPLIFIER

HIGH IMPEDANCE FET PREAMPLIFIER. (January 1967, File No 1/PRE/16.) Although the key device in this circuit is a FET it also uses two BC108s. As shown, the circuit has an input impedance of 5M, a gain of 30, and a total harmonic distortion of 0.1% at 1V RMS out. Frequency response is from 20Hz to 35kHz at the -3dB points. By varying specified components it is possible to vary these specifications to suit particular applications. For example, the gain may be increased at the expense of reduced input impedance, or vice versa.

The high input impedance makes the unit particularly suitable for use with crystal microphones or ceramic pickups, which require loads of about 5M and 2M respectively. The output impedance is quite low, making it suitable for connection to low input impedance amplifiers as well as high impedance types.

Construction is simple, involving a short length of tag board, but a metal box is essential to prevent hum injection into the low level, high impedance input circuit. Current drain from a 9V battery is only about 3mA.



FUZZ BOX

FUZZ-BOX FOR GUITARS. (August 1967, File No. 1/GA/10.) For the guitar enthusiast, this simple device will have a lot of appeal. Using two BC108s and a few resistors and capacitors it can be built for a modest cost. It is designed to be interposed between the guitar and the main amplifier, thus confining the "fuzz" effect to the guitar signals only. It is fitted with a foot switch to allow selection of "fuzz" or "normal" as required; the level remains much the same in both modes, the degree of "fuzz" is variable, and the unit provides a small amount of gain.

The unit can provide a wide range of wave shapes, from simple half wave clipping to complex peaks. As well as the unit's own control, the guitar's volume control can be used to vary certain aspects of the wave form.

The unit is battery powered, thus making it completely self-contained. The prototype was built into a small metal box with a sloping front on which the foot switch was mounted, the whole unit being designed to sit on the floor near the player's foot. Most of the circuit can be built on a short length of tag board, or strung between it and the input and output sockets, controls etc.

PROJECTS BOOK

As well as the projects illustrated on these pages, there are a number of others, all making good use of the BC108, which space does not permit us to illustrate. Several of them were featured in our "Projects and Circuits" handbook, and we list them briefly below for our readers' guidance.

A SIMPLE MOISTURE ALARM. An easy-to-build device which will serve as a rain alarm on washdays or as a splash alarm to supervise a swimming pool. It uses four solid state devices, two of them BC108s.

MODEL TRAIN SIGNALS. An interlocked signalling system in which red and green signal lights are controlled by the movement of the train. Each signal requires 2 BC108s and two diodes, plus a reed switch and two lamps. Very simple to build and extremely reliable.

ELECTRONIC STEAM WHISTLE. Another sound effect device, this time for the model railway enthusiast. A little more complicated than the first two projects, but not unduly difficult if built and tested section by section. Uses seven solid state devices, five BC108s and two diodes

ELECTRONIC BONGOS. Another musical sound effect device, this time simulating the bongo drums. It is "played" by tapping a touch plate with the fingers. A simple circuit using two BC108s.

If any of these projects interest you we suggest you obtain a copy of our "Projects and Circuits" handbook without delay. The projects listed are only a few of the 30 odd which it contains. It is available from new-sagents or our office for \$2.00, or \$2.60 posted to anywhere in Australia.

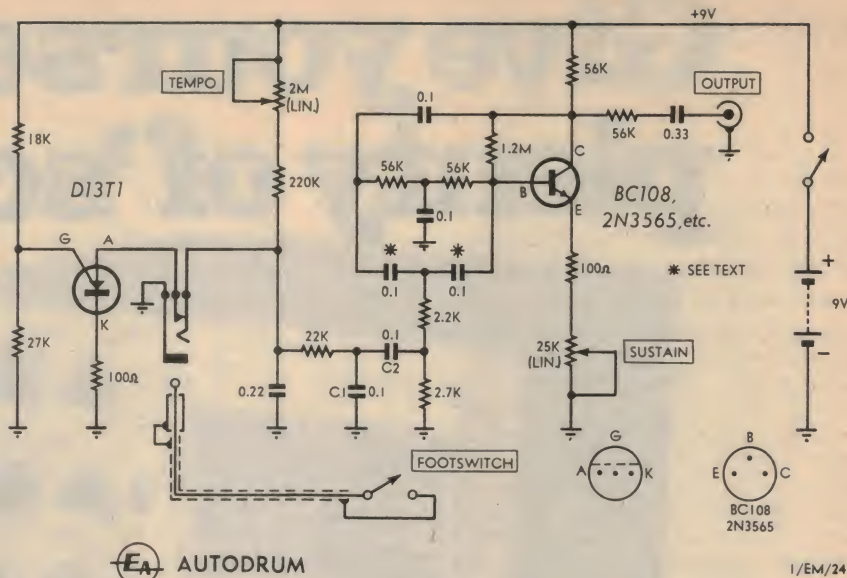
PHASE VIBRATO UNIT. (March 1969. File No. 1/EM/21.) Some form of vibrato is desirable in most electronic organs, but provision of true vibrato (frequency shift) can present a number of problems, particularly where it is desired to add it to an existing instrument.

Shifting the phase instead of the frequency can produce much the same effect and has a number of practical advantages. The circuitry can be relatively simple and, more importantly, does not involve the tone generators directly. This means that it can be applied only to those sections of the system which will benefit from it.

The modulating frequency (around 8Hz) is generated by a phase shift oscillator (T4) and used to modulate a small lamp optically coupled to an LDR associated with T1. The LDR forms part of the phase shift network and signals fed to T1 appear at the output (T3) phase shifted at the oscillator rate.

The circuit uses six BC108s, plus a few other solid state devices and the usual resistor and capacitors. No unduly expensive components are required and the physical layout is not unduly critical. The main requirement is to provide a light tight housing for the lamp/LDR combination.

The power requirement is 9V at about 18mA. While it could be operated from a battery on an experimental basis, a small power supply or a dropping network from the main supply rail would be a more practical proposition.

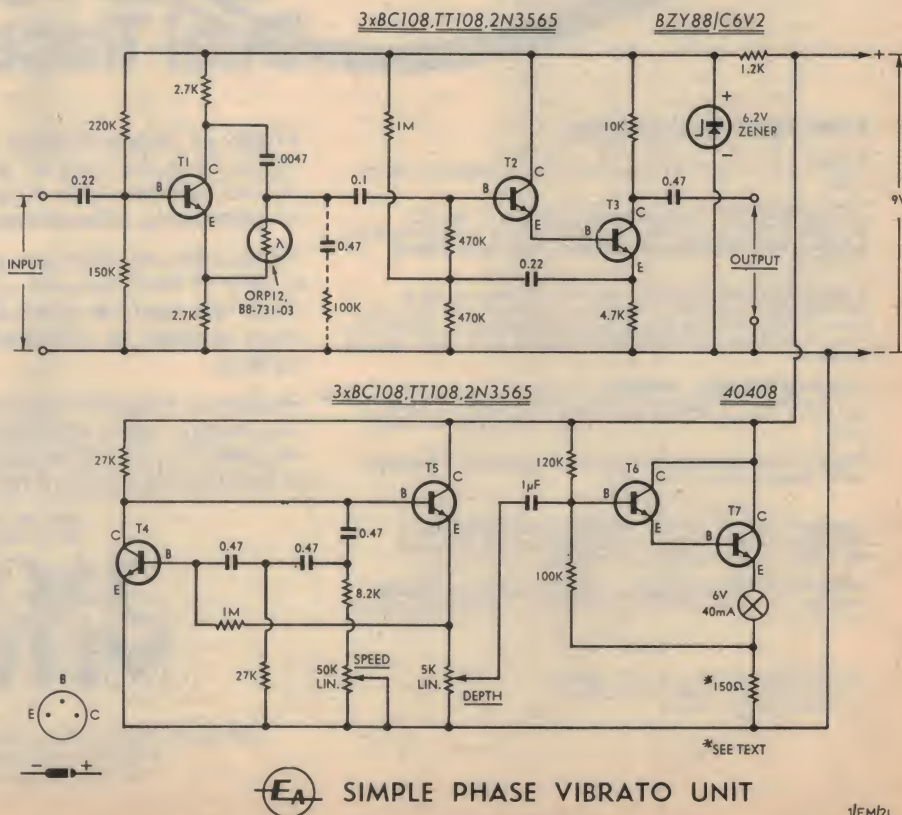


THE AUTODRUM. (May 1970, File No 1/EM/24). This simple unit generates a drum-like damped oscillation which sounds most impressive when fed into a higher power amplifier. It uses only two solid state devices, one of which is a BC108.

The beat rate may be determined in two ways; directly by the musician operating a foot pedal in much the same manner as for a real drum, or by means

of an internal oscillator, the speed of which may be pre-set by the musician.

The whole unit can be accommodated in a small diecast box and powered from an internal battery. At 9V, current drain is approximately 0.5mA. Construction is on a length of tag board, and is not critical. The tone of the drum can be varied over a wide range, from a bass drum to a kettle drum, or even imitate a set of tom-toms.



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Trigger: Variable level control with option of bright line in absence of signal. **Source** Internal Y1 + or —
Y2 + or —
External + or —

Coupling AC, AC fast TV Frame. **Sensitivity** Internal 2mm approx. 40Hz-2MHz. External 1V approx. 40Hz-2MHz. Internal 1cm approx. 8Hz-10MHz. External 5V approx. 8Hz-10MHz.

Additional Facilities: Calibrator 1V \pm 2% square wave at supply frequency. Dimensions .18cm(7") x 29cm(11½") x 42cm(16½"). Approx. 7 kg.(15 lb).

Specifications quoted are for general guidance only, are subject to verification and change without notice.

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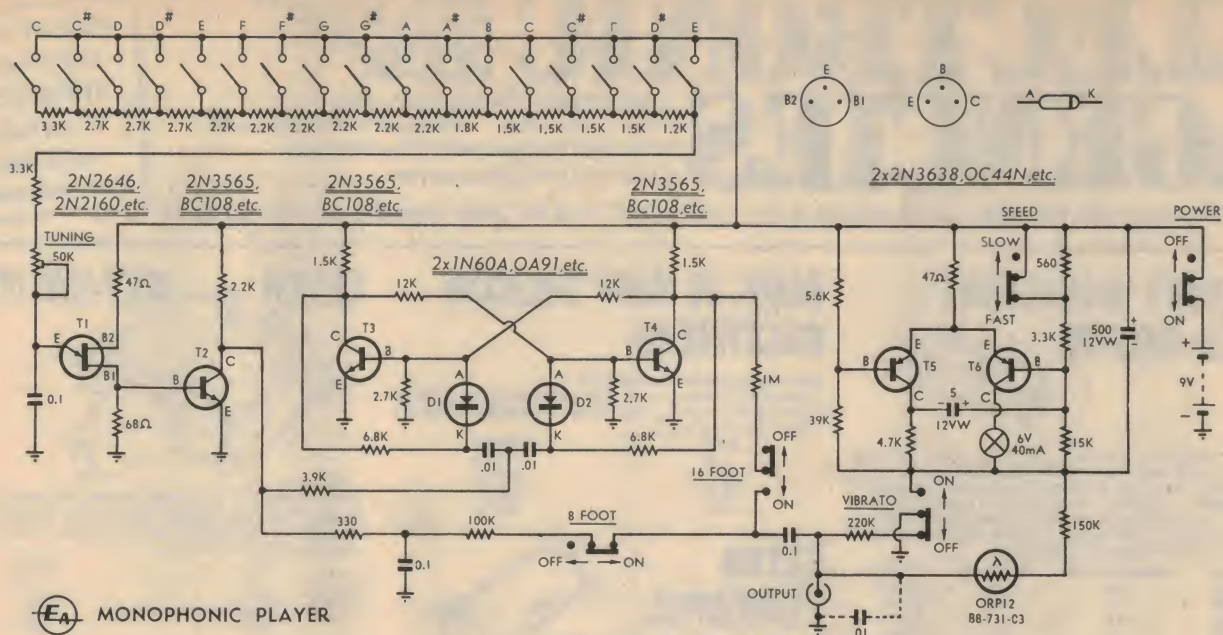
Particular attention has been paid to trigger performance, and the system used includes a variable control with bright line operation in the absence of a signal, or when the trigger level is outside the range of the input signal.

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MONOPHONIC PLAYER. (January, 1968, File No. 1/EM/18.) This is a development from a single monophonic organ described the previous month, with the aim of converting it from a mere toy to a serious instrument which could take its place in a musical group.

Two main refinements are the addition of an extra octave and a vibrato facility. There are also suggestions as to how these ideas might be expanded further.

The extra octave is provided by two-to-one division of the basic oscillator frequency, using a gated R-S flip-flop. Either octave may be selected by means of key switches, or both may be presented simultaneously, providing a richer sound.

The vibrato facility uses the now well established technique employing an LDR optically coupled to a small lamp. The lamp is energised from a low frequency oscillator and the LDR acts as a variable resistor in the signal circuit.

The circuit uses eight solid state devices, including 3 BC108s and two diodes.

POKER MACHINE

This special offer would be an ideal source of components for one of our most intriguing circuits: the Electronic Poker Machine, another of our Projects and Circuits hand-book features.

The circuit calls for 37 transistors, originally specified as 083s (ex computer boards) but which can be replaced without circuit changes by BC108s or their equivalent. It also uses 91 diodes, small signal variety (ex computer boards) but which, again, can be replaced by the units in this offer, without circuit changes.

It is not an unduly complex device to build, although a fair amount of repetitive wiring is involved. It can be built in two stages, the first, and simpler one, displaying the combination but giving no indication as to whether it is a paying one. This must be determined from a paying combination chart.

Addition of the second stage allows the winning combinations to be recognised by appropriate circuitry, and the value of the combination indicated.

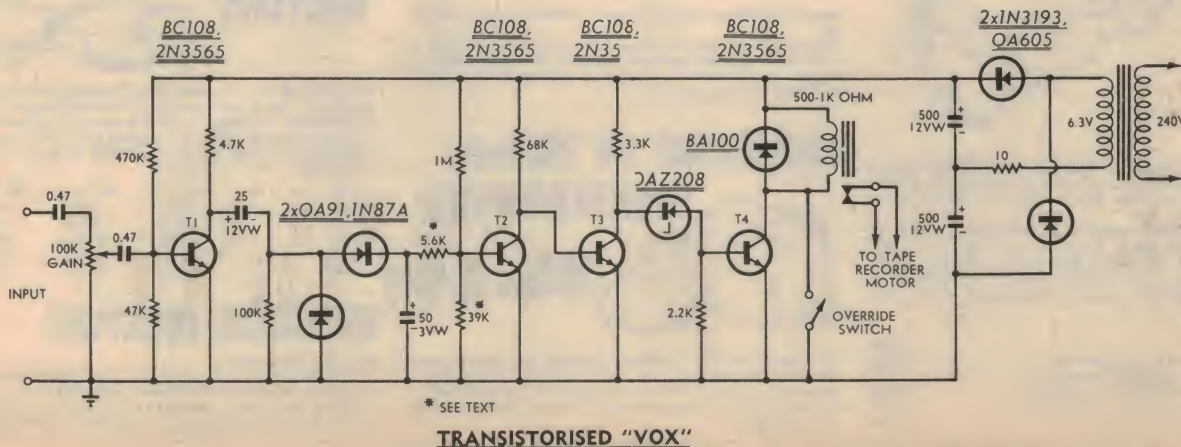
To cater for this project Dick Smith has organised a package of 40 transistors and 100 diodes, price \$7.00, plus 50c for post and packing.

"VOX" CONTROL. (August 1966, File No. 1/RA/27.) Originally developed as a vox control for an SSB transmitter, it was presented in this article as suitable for tape recorder control. One of its main features is a very fast attack time, aimed at minimising loss of the first syllable of the first word.

The control actuates a relay which may be connected in the motor circuit or other control circuit of the recorder, so that the recorder functions only when there is signal to be recorded.

A typical use would be to monitor a modile radio channel, either to provide a record of message for subsequent checking, or to assess the traffic density on a particular channel over a given period. Use of the vox avoids unnecessary running and waste of tape and, on replay, avoids waste of time listening to long periods of silence.

The circuit uses four BC108s and two small signal diodes, plus three larger diodes and a zener.



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PLESSEY MINIATURE REED RELAYS

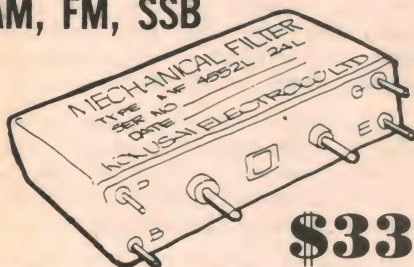


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2 Pole	6	75	\$2.95
2 Pole	12	360	\$2.95
2 Pole	24	1120	\$2.95
3 Pole	6	62	\$3.50
3 Pole	12	235	\$3.50
3 Pole	24	975	\$3.50

Limited quantities available!

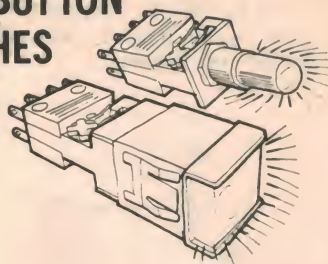
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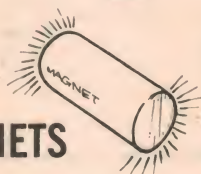
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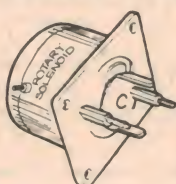
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The popular EDI PA40 Minibrige is easy to use and features single hole mounting to chassis, etc. Normal selling price is around \$6-\$7. Our special price (while stocks last) is \$5.50 ea. for 1 to 4, or \$5 ea. for 5 or more.

ROTARY SOLENOID

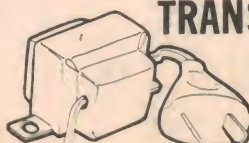


\$8.90

New 12 volt Rotary Solenoid Switch Motor by Plessey. \$8.90 ea.

This electro-mechanical rotary actuating mechanism will suit all OAK type F switches up to 12 positions. Small in size, they are robust, easy-to-mount and made to professional standards. Only 50 available, so be early.

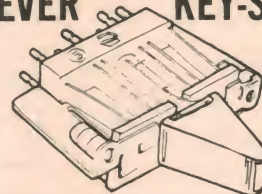
MINIATURE 6V 200mA TRANSFORMERS



\$3.50

As used in AC/DC cassette recorders and radios, these shielded transformers have 240V primary and 6V-0-6V secondary at approx. 200 m A. Size 38 x 38 x 33 mm with mtg centres at 48 mm. Complete with 2 core flex and plug. \$3.50 ea. 10 for \$30.

LEVER KEY-SWITCHES



DPDT Centre-Off; Silver-plated contact for long life. These modern PMG type miniature keyswitches (as used in latest telephone switchboards) feature positive action, long life operation and easy mounting.

QTY.

1-9

10-24

25-99

100+

PRICE

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85c

80c

75c

P.C.B. EDGE CONNECTORS

NOW! Custom build your own P.C.B. Edge Connectors. Featuring gold plated contacts and designed for single-sided boards, these top quality 12" long connectors hold 78 contacts at 0.156" pitch. Simply cut the length required and fit mounting clips (2 included, extras 5c ea.). \$1.20 ea. or 10 for \$10.

EDGE CONNECTORS



85c

46 way double-sided Edge-Connector with gold-plated contacts. Can be used as 23 way single-sided connector, 0.156" pitch, with mounting holes at 4" centres. At these prices you can add that "professional" touch to all home-brew projects. 85c ea. 10 for \$7.50.

MULTI-PIN CONNECTORS



At BARGAIN PRICES. A scoop purchase of these top-grade connectors enables us to sell below manufacturer's cost prices. Suitable for panel mounting or in-line applications, these miniature connectors have low contact resistance and long life.

Gold-Plated Polarised Connectors

	PLUG	SOCKET	COVER
9 pin	50c	50c	30c
15 pin	70c	70c	50c
50 pin	\$1	\$1	70c

MICRO-MINIATURE CONNECTORS



When space is at a premium, and quality and low cost is important, try these amazing Micro-Miniature Plessey Connectors. Socket suits panel mounting, plug mates firmly with socket due to screw-down action of plug and the cable is secured by a clamp. Each set includes 1 plug, 1 socket, 1 cable clamp.

TYPE	QTY. 1-4	QTY. 5-24	QTY. 25+
3 pin	85c	75c	65c
7 pin	95c	85c	75c
14 pin	\$1.20	\$1.10	\$1.00
19 pin	\$1.50	\$1.35	\$1.20
37 pin	\$1.80	\$1.60	\$1.40

BONANZA JACKPOT!

\$25 value for only \$5.

For experimenters and constructors, a large assortment of new, highest quality electronic components — samples, specials, end-of-line components including semiconductors, etc. This is real anti-inflationary VALUE FOR YOUR MONEY!

OTHER REFERENCES

A number of other projects, which space prevents our displaying in greater detail, are listed below. All make good use of the BC108.

SOUND EFFECT SYNTHESISER.

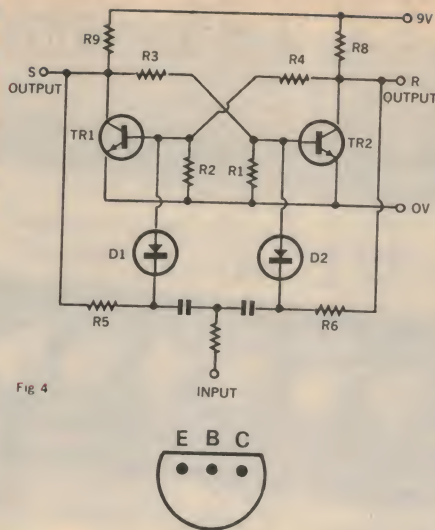
(October-November-December 1971, File Nos. 1/EM/25-26-27.) Ten separate circuits covering 10 individual sound effects. Makes extensive use of the BC108.

KEYLESS ORGAN. (January 1969, File No. 1/EM/19) Development from the Monophonic Organ described elsewhere on these pages. Uses a stylus and pattern of contacts to replace the keyboard, thus minimising the mechanical problems.

HIGH IMPEDANCE 4-CHANNEL MIXER.

February 1967, File No. 1/MX/7.) Uses five BC108s, four FETs, and minor components. Has four inputs, two for microphones, two for pickups. All are capable of an input impedance of up to 5M.

ELECTRONIC CYMBAL. (November 1972, File No. 1/EM/29.) A simple circuit using four BC108s. Imitates the sound of brass cymbal struck with a drumstick.



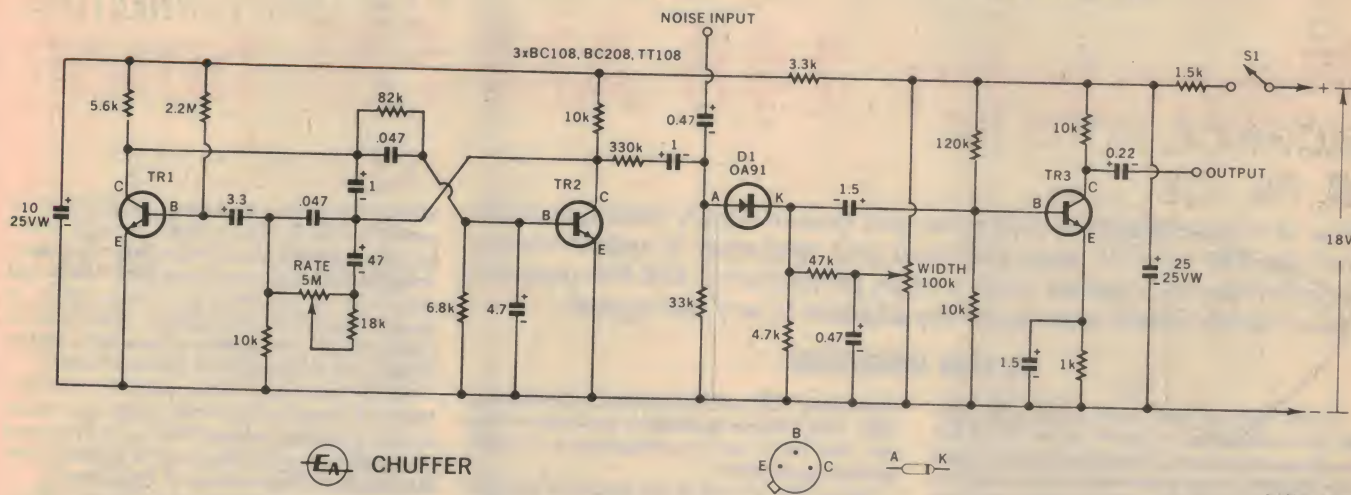
The PC208 is a plastic encapsulated transistor with three in-line pins. The pin arrangement is shown above.

MULTIVIBRATOR SERIES. (October, November 1972; January, February 1973. File Nos. 8/DT/60, 61, 63, 64.) This was a tutorial series commencing with a theoretical description of the basic multivibrator circuits, followed by a number of simple practical experiments aimed at demonstrating the theory.

The series also demonstrated the basic principles of binary coding and decoding including construction of a simple counter and binary decoder. Almost all the circuits could be built using BC108s and small signal diodes, plus a few resistors and capacitors.

It would be an excellent series of experiments to include in a club syllabus, particularly now that the components are available at such an attractive price. Also ideal for the individual who wishes to catch up on this phase of electronics.

Most of the circuits drive indicator lights which makes the purpose of the exercise readily apparent, even to non-technical onlookers.



3 MS / 38

THE "CHUFFER". (February 1973, File No. 3/MS/38.) For the model railway enthusiast. A sound effect simulator designed to imitate the traditional "chuff chuff" of a steam train. A useful companion unit to Steam Whistle mentioned elsewhere in these pages and, in fact, it uses the white noise output from the latter. If necessary it could be made self contained by duplicating this part of the Whistle circuit.

There is provision to vary both the rate of "chuff" and the duration or "width" of the chuff. With a little practice it can be made to imitate anything from the slow pulsing of the Westinghouse brake compressor to the rapid panting of a loco at full throttle.

The circuit uses three BC108s and one small signal diode, plus resistors and capacitors. It is a simple circuit, may be constructed on tag board, and is not critical as to layout. It operates from an 18V supply and the drain is low enough to suit battery operation. Alternatively, it can be fed from any convenient power supply.

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Enclosed is my cheque/postal order for \$.....Please forward
pkt(s) of 20 germanium diodes at \$ 1.00 per pkt
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Playmaster 146 AM-FM tuner

Here is a dual selectivity AM tuner and power supply designed to go with the FM tuner IF strip and front end described in recent issues. Together the two tuners form a high performance AM-FM program source which would make a worthy addition to any hi-fi system.

by IAN POGSON

In July last, we described an IF strip with decoder and filters for an FM tuner. Then last month we described a matching tunable front end. Together, they go to make up the nucleus of a complete FM tuner. This month, we will describe an AM tuner which has been designed to be integrated with the FM tuner in a single cabinet. We are confident that the finished article will be worthy of any hi-fi system.

A considerable amount of thought was given to the question of what would be an appropriate AM tuner design to go with the FM counterpart. Should we cut it to a bare minimum—a straight AM tuner with normal sharp selectivity—leaving the FM side to give the only choice of high quality audio? This is what is almost universally done in commercial tuners.

It seemed reasonable to suppose that listeners to the FM high quality transmissions would welcome at least the choice of being able to listen to the AM service with a measure of high quality under favourable circumstances. "Under favourable circumstances" is the key to the argument. There are times when the wide band mode of AM reception would result in various forms of interference in many localities, particularly at night. This means that the idea of providing only wide band selectivity would be unsatisfactory in many instances. In short, if we are to have wide band reception, we must also provide for the conventional sharp selectivity as well.

Many ideas were considered as to how best to achieve both sharp and wide band selectivity, with particular emphasis on economy. Finally, we decided that the best approach would be the one already proved in the

Playmaster 138 tuner described in December, 1972. This, therefore, became the basis for our new AM tuner, with modifications to suit the present application.

Let us take a look at the circuit of the AM tuner, together with the power supply for the complete unit, and the circuitry interconnecting both tuners.

In contrast with the Playmaster 138, we have made considerable changes to the RF stage. For the first time in a tuner of this type, we have used a ferrite rod aerial. Due to the exceptionally high Q of this aerial circuit, it has been necessary to dampen it down somewhat with a 120k resistor. Also, coupling between the tuned circuit and the gate of the RF amplifier has been kept very light—via a 4.7uF coupling capacitor. A second tuned circuit is included in the drain of the RF amplifier, the output of which is fed to the base of the following self-oscillating mixer.

The self-oscillating mixer is the same as we have used before. It is important to note that with this circuit, the 0.01uF capacitor shunting the 470 ohm emitter resistor is fairly critical and should not be increased above this value.

The three tuned circuits are tuned by means of the new special Roblan composite 3-gang capacitor. The AM section has a maximum capacitance of 240pF per section and as no provision has been made to make this design padderless, it is necessary to fit a padder of 200pF in series with the oscillator section. This is made up by connecting two 100pF capacitors in parallel.

Following the mixer is a 455kHz IF strip, with switchable sharp and broad selectivity. This is done in the same way as previously. Prior to

the first IF amplifier we have a sharp selectivity circuit consisting of two single tuned IF transformers coupled via an impedance matching network and a double ceramic filter. The broad selectivity is obtained by overcoupling a double tuned IF transformer. Selection of either circuit is by means of four germanium diodes, DC switched from the front panel.

As the main part of the selectivity characteristic is determined in the stage just mentioned, coupling between the first and second IF amplifiers is by means of a permanently overcoupled double tuned IF transformer.

The detector is a germanium diode voltage doubler type, which gives quite a high level of audio output. Also, the DC developed is higher than from a single diode detector and this is an advantage when the DC voltage is used for AGC purposes. AGC is picked off via the 1M filter resistor and fed to the RF amplifier and the first IF amplifier.

Audio from the detector is fed into a Darlington pair, in order to transform from a high impedance for the detector, to the low impedance necessary for the bridged-T whistle filter. The purpose of the whistle filter is to notch out the 10kHz component resulting from heterodynes between the wanted station carrier and those on adjacent channels, under wide band conditions.

Following the whistle filter is an audio frequency treble boost network combined with the audio output level trimpot. The purpose of the treble boost is to make up for the slight treble cut which results from the restricted bandwidth of the aerial and RF tuned circuits.

The signal strength meter performs the dual function of signal strength for both AM and FM tuners. To achieve this, it has been necessary to combine the two circuits to some extent and this has necessitated the use of an isolating germanium diode to make for a completely satisfactory arrangement. The AM meter zero adjustment is done with a 1k trimpot, in series with a 4.7k resistor.

PLAYMASTER 146

However, providing the necessary mechanical differences can be accommodated, an equivalent type could be substituted.

The PC board should be available from the usual outlets. The board for the AM tuner was made by RCS Radio who also can supply the other two boards for the complete project.

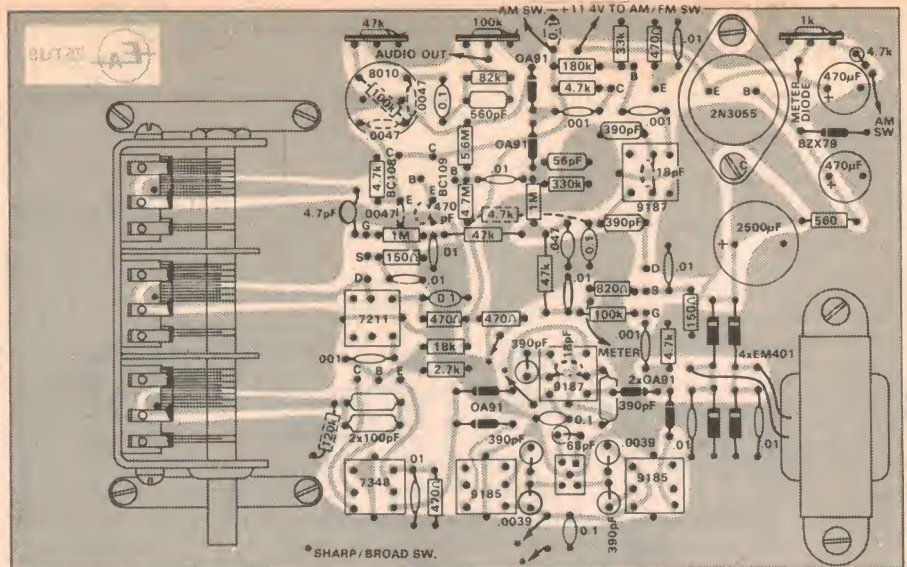
There are two push-button switch assemblies used, both available under the name of Isostat from McMurdo. One switch consists only of one DPDT unit and the type number without button is 3828-1. The other assembly consists of a bank of six DPDT units and the type number without buttons is 3829-6. It should be noted that the latter assembly has been made available specially for this project and that there is a choice of push-buttons, with different finishes and quite a wide range of price tags.

The front panel is a departure from our usual practice. Instead of a metal panel, we have used one of a clear plastic material. The general background is black with white lines and lettering and the dial scale is a clear window with black lettering and calibrations. This is viewed against a white panel spaced about 10mm behind the plastic panel. The cursor is in red and the meters, one at either end of the scale, are illuminated.

The plastic panel is silk screened and made by RCS Radio Pty Ltd. It is possible that other manufacturers may also make a suitable panel available.

Apart from the dial scale just referred to, such other parts for the dial drive as the drive spindle and bush assembly and pulleys are available through Watkin Wynne. The dial pointer, which runs on the top of the front metal panel, may not be easy to obtain but it is quite easy to make one up; more will be said about this later on. The dial drum is imported by John Carr and if you intend to use our calibrated front panel, then the use of this drum is mandatory.

Metalwork is quite simple and as such, should be less expensive than some more demanding designs. There are three plates,



The component layout shows the PC board from the component side. External connections are via PC stakes. Take care to ensure correct orientation of polarised components.

one each for the front and back panels and a bottom panel. The whole is held together with a framework of aluminium angle (16mm x 16mm x 1.5mm), cut to size and screwed together. The metalwork is simple enough for the average handyman to cope with himself but it should also be available ready for assembly through the usual channels.

The wooden cabinet is very simple, but effective. It consists of a four sided sleeve and would be within the capability of the average handyman to make himself. We made ours from $\frac{3}{4}$ inch thick particle board and veneered it with the readily available pre-glued iron-on veneer.

We will assume that you have already made up the items already described for the FM part of the project. It now remains to make up the board for the AM section and then fit the lot into the final assembly and then into a cabinet. While the amount of work involved is not inconsiderable, the finished article is well worth the effort.

A logical place to start construction would be the printed board. This task is made easy as all components are clearly shown on the diagram. Fit all the small components first, followed by components of increasing size, finally finishing up with the power transformer and gang. There are a number of components underneath the PC board and these are shown dotted on the diagram.

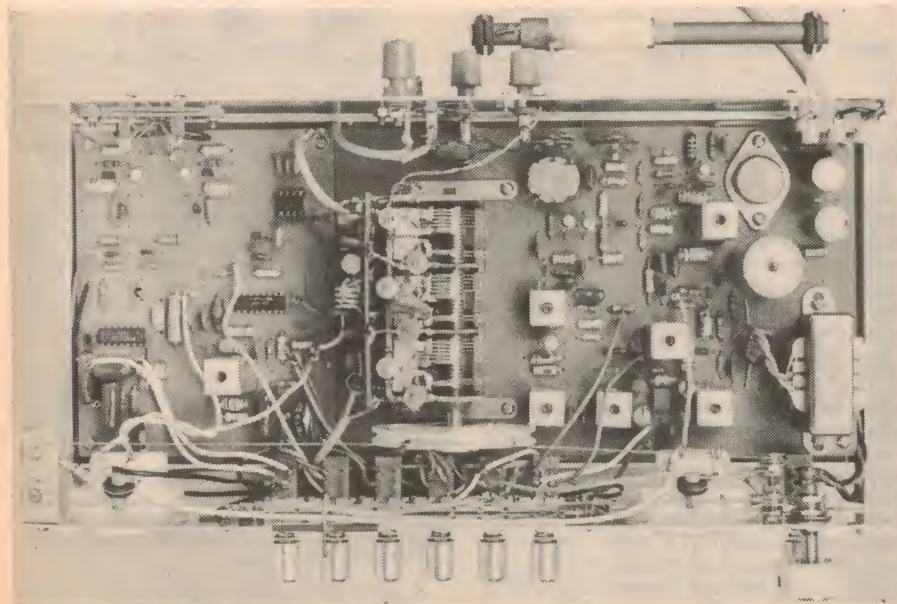
Points to watch when doing this job are to make sure that diodes and electrolytics are polarised correctly. Care should be taken with transistor connections. Coil cans should be seated properly before the connections are soldered. Care should also be exercised to make sure that the whistle filter coil is connected the right way round. The ceramic filter calls for special care in soldering, as the connections are small and close together.

Having finished fixing the AM tuner and power supply components to the board, the FM front end may be added as well. Before doing so, some tinned copper wire leads should be added to the three bottom AM section lugs of the gang. These leads should be fixed and soldered to the lugs such that when soldering the lead later on to the copper of the board, the lead will not fall off the gang if the soldered joint should melt. The three trimmers for the AM sections may also be fitted to the gang. Now screw the front end assembly to the main board, cut and bend the TC leads just referred to and solder to the appropriate points on the main board.

If you have already mounted the front end on a special board of its own, as described last month, then it would have been necessary to remove it from that board and then fix it to the new board as just described. The corresponding edge of the new board will now have to be fixed to the FM IF board assembly, in the same manner as already described last month. Thus assembled, the whole unit may have six 1/2 in spacers screwed to the holes provided.

Using the five separate pieces of aluminium angle, the framework may be assembled. This is quite a simple operation and the complete board assembly may be incorporated into the angle frame.

The aerial loopstick is mounted on the back panel with two L shaped brackets. These may be readily made up using scraps of about 20



This view shows the completed tuner chassis with the three major sub-assemblies in position. Details of the dial stringing arrangement are also visible.

PLAYMASTER 146 AM-FM STEREO TUNER

gauge aluminium. The brackets are 24mm wide, 32mm high, with a 12mm foot. The grommet which we used required a $\frac{3}{16}$ in slot, first made by drilling a $\frac{3}{16}$ in diameter hole and opening it into a slot with a hacksaw and finishing with a file.

The components, including the loopstick, terminals, sockets and balun transformer may now be assembled on to the back panel, which in turn, may be screwed to the angle frame.

Compared with the back panel, the inside front panel has rather more components associated with it. Before starting this assembly, if you have not been able to obtain a suitable dial pointer, then now is the time to make one. The slider is made up from a piece of flat tin plate; a piece from a jam tin would do. Cut a flat rectangular piece, 38mm long and 16mm wide. This has to be bent up longitudinally in the form of a thin U. The aid of a vyce, hammer, and a small piece of flat metal, a little thicker than the front panel on which it will slide, will be required for this operation. I will leave it to your ingenuity, rather than attempt a lengthy description of how it may be done.

Having made the slider, a pointer is also required. We made ours from a piece of 16 gauge tinned copper wire, about 90mm long to start with. Place the slider on the top of the panel on which it will slide, with the wire at the centre of the slider and at right angles to it, and solder the two together. Leave about 22mm hanging over the back, with the rest towards the front. About 8mm of the shorter piece is now folded back on itself, to the underside, leaving a gap of about $\frac{1}{2}$ mm. At 10mm from the centre of the panel and slider, bend the front piece of the wire down at right angles and parallel with the panel. The long piece should now be cut off, 50mm from the bend.

We gave our pointer a coat of red enamel, leaving the double bent piece at the back unpainted. Incidentally, the bent piece will actually clamp the dial drive cord later on.

Now fit the 6-bank push-button switch to the front panel. Make sure that it is the right way around, with respect to the FM and AM interlocking switches. The single push-button switch and the dial drive bush assembly are next. The two meters may luckily be just a neat push fit into the holes and this will be enough to hold them. However, we are not always this lucky and so a good way of fixing is to use a small quantity of PVA or other suitable glue applied to each of the mounting lugs. Make sure that they are held properly in place while the glue sets. At this point, the panel may now be fixed to the angle frame.

The major part of assembly is now finished and the interwiring may be done now. Wiring between the push-button switches and other points calls for care, but may be carried out by running wires in any reasonably short route. Audio output leads from both tuners to the switch and the two output sockets are run in thin shielded cable. The braids are earthed at one end only, the braid being cut off short at the switch ends. The .01uF capacitor across the tuning meter is connected across the meter terminals. The diode and the 5.6k resistor are connected right at the terminals of the signal strength meter.

The leads from the aerial loopstick coil are passed through the grommet on the back panel and the surplus length cut off. The tap, or twisted pair is connected to the frame of the gang near the back section of the AM capacitor. The top of the coil is terminated at the lug of the same capacitor. The bottom low impedance lead is connected to the external

AM aerial terminal. While we are on aerial leads, the lead from the front end input to the balun and coax socket is run in thin shielded coax lead as was used for the audio circuits.

When wiring the single push-button switch for the mains ON-OFF, make sure that all contacts are well clear of other metal parts. We covered all lugs with short pieces of sleeving, including those which are wired to the transformer and terminal strip on the back panel. When terminating the mains cord to the terminal strip, clamp it to the back panel just above the grommet and next to the mains terminal block.

In the prototype, we made the holes for the three LEDs so that they were a fairly neat fit. After wiring each one in place, we fixed each one with a drop of PVA glue. We found it convenient to shorten the leads of the LEDs just a little, the common leads of the green and yellow being connected together and a lead run to a nearby earth terminal on the PCB. Each of the two LEDs just mentioned has a 680 ohm resistor connected to each respective lead, right at the LED. Hookup wire completes the leads, which are terminated conveniently at the AM/FM switch.

Part of the dial stringing includes a small L shaped bracket. This is made from a piece of 16 or 18 gauge aluminium, 12mm wide with a 9mm foot and the main arm 32mm long. A hole is drilled in the foot for mounting on the front panel and two more holes are drilled 15mm apart and one 9mm from the bend. We tapped the two holes on the main arm to $\frac{1}{16}$ in Whitworth but if you are unable to do this, we suggest that you stick nuts with epoxy resin on the underside. This allows the two pulleys to be fixed with $\frac{1}{16}$ in Whitworth screws, so that they run freely. Then the screws may be permanently set with two lock nuts.

Towards the other end of the front panel, two pulleys are mounted on a 1in x $\frac{1}{16}$ in Whitworth RH screw. The screw is first fixed to the panel with one nut. A pulley is slipped on and

LIST OF COMPONENT PARTS FOR THE NEW TUNER

- 1 IF strip with decoder (see July 1975)
- 1 FM front end (see August 1975)
- 1 Set of metalwork
- 1 Cabinet
- 1 Front panel (EA75TU10)
- 4 Rubber feet
- 3 Rubber grommets, 3/8in
- 1 Rubber grommet, 5/16in
- 1 RCA stereo socket
- 1 3-way mains terminal strip
- 3 Jabel aerial terminals, 1-red, 2-blue
- 1 Belling & Lee coax socket
- 1 Jabel drive spindle & bush assembly
- 4 Jabel dial cord pulleys
- 1 Jaycar plastic dial drum, 57.3mm, type Z6
- 1 Dial pointer (see text)
- 1 1m length dial cord
- 2 Lilliput lamp sockets
- 2 Rubber grommets to fit sockets
- 2 Lilliput lamps, 6V 0.36W (60mA)
- 1 Isostat switch assembly, 3828-1 (McMurdo)
- 1 Isostat switch assembly, 3829-6
- 7 Buttons for Isostat switches
- 1 Printed board, 203mm x 127mm (EA 75TU9)
- 9 Printed board terminal pins (McMurdo)
- 6 $\frac{1}{2}$ in long x $\frac{1}{16}$ in dia brass spacers, tapped $\frac{1}{16}$ in Whitworth
- 1 Ferrite rod aerial coil, Jabel 7154 or Aegis S211
- 1 RF coil, Jabel 7211 or Aegis S196

- 1 Oscillator coil, Jabel 7348 or Aegis S201
- 2 Double-tuned 455kHz IF transformers, Jabel 9187 or Aegis S240
- 2 Single-tuned 455kHz IF transformers, Jabel 9185 or Aegis ST45C
- 1 Whistle filter coil, Jabel 8010
- 1 Ceramic filter, Murata SFD455B
- 2 Transistors, 2N5485, FE5485, etc
- 2 Transistors, BF115, TT1002, etc
- 1 Transistor, BC109 or equivalent
- 1 Transistor, BC108 or equivalent
- 1 Transistor, 2N3055
- 1 Zener diode, BZX79C12
- 4 Diodes, EM401, etc or 1 only WO2 (see text)
- 7 Diodes, 0A91
- 1 LED, yellow type 5082-4584

RESISTORS

($\frac{1}{2}$ W or less unless stated otherwise)

- | | |
|--------------|----------------|
| 2 150 ohms | 2 47k |
| 5 470 ohms | 1 47k trimpot |
| 1 560 ohms | 1 82k |
| 1 680 ohms | 2 100k |
| 1 820 ohms | 1 100k trimpot |
| 1 1k trimpot | 1 120k |
| 1 2.7k | 1 180k |
| 4 4.7k | 1 330k |
| 1 5.6k | 2 1M |
| 1 18k | 1 4.7M |
| 1 33k | 1 5.6M |

CAPACITORS

- 1 4.7pF NPO ceramic
- 2 18pF NPO ceramic
- 3 20pF trimmers, Phillips or McMurdo
- 1 56pF 630V polystyrene
- 1 68pF 630V polystyrene
- 2 100pF 630V polystyrene
- 6 390pF 630V polystyrene
- 1 470pF 630V polystyrene
- 1 560pF 630V polystyrene
- 4 .001uF 200V polycarbonate
- 2 .0039uF 630V polycarbonate
- 3 .0047uF 200V polycarbonate
- 7 .01uF 200V polycarbonate
- 2 .01uF 63V ceramic
- 1 .047uF 100V polycarbonate
- 6 0.1uF 100V polycarbonate
- 2 470uF 16VW electros
- 1 2500uF 25VW electro

MISCELLANEOUS

Hookup wire, solder, solder lugs, screws and nuts, 3-core flex, 3-pin plug, 1m light coaxial cable.

Notes: Resistor wattage ratings and capacitor voltage ratings are those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

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100 MHz 465

Dual Trace 5 mV
Delayed Sweep 5ns
Bright 18 KV

10 MHz D61

Dual Trace. 10 mV
T.V. Triggering facilities.
Bright 3.5 KV

50 MHz D83

Dual Trace. 5 mV
Delayed Sweep 5ns
Bright 15 KV



25 MHz D66

Dual Trace. 1 mV
T.V. Triggering
Bright 10 KV



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another nut follows, set so that the pulley keeps the cord parallel with the panel. Run another nut on to lock the one adjacent. Then run two more nuts on the screw, with a solder lug between them. Lock the nuts, with the lug looking towards the meter and leaving enough room for the second pulley.

To do the dial stringing you will need a piece of nylon dial cord just under 1m long. This gives enough to handle and tie the ends, any surplus being cut off later on. Fitting a dial cord is never a particularly easy job but to help in the operation, we have supplied a simple sketch. Follow this carefully, loop the cord $2\frac{1}{2}$ times around the drive spindle and adjust the tension by stretching the spring as much as possible within the limited space. The spring will be extended by about 8mm or so.

A "lilliput" lamp has to be fitted adjacent to each of the meters. Slide each socket into a neat fitting rubber grommet. Make a loop of 16 or 18 gauge TC wire to fit neatly and firmly around each grommet and bend the wire at right angles for about 25mm. Fit a solder lug under one of the lock nuts of the L bracket near the tuning meter. The wire of the lamp socket assembly is soldered to its respective solder lug, so that the lamp is over the centre of the meter—the lamp should clear the body of the meter and the front panel by about 1mm. The sockets are wired in series, picking up the 12V supply and earth from points on the switches.

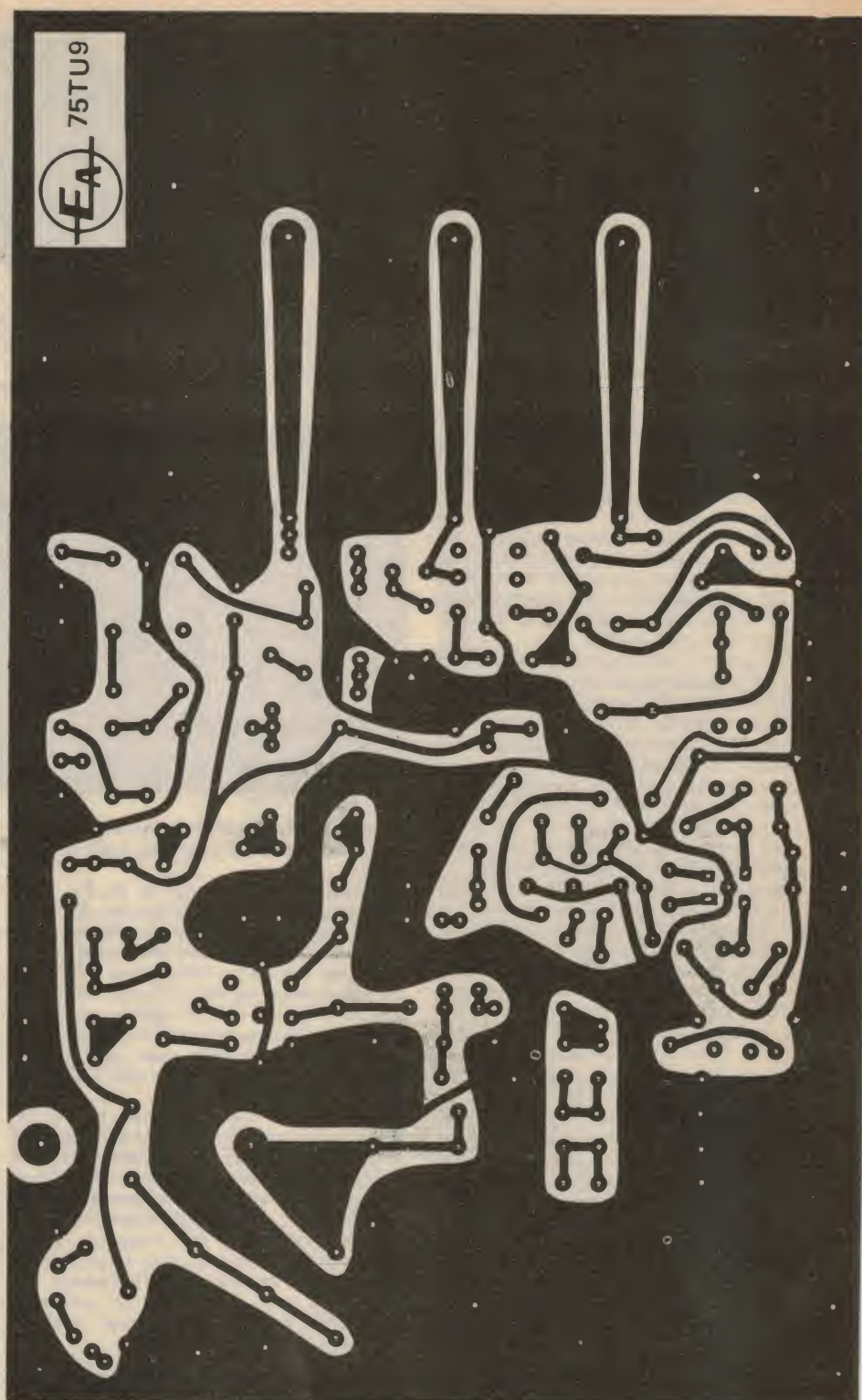
This virtually completes construction, with the exception of a cabinet. The next job is to adjust and align the AM tuner, the FM part having already been covered previously.

As the dial scale proper is on the outside front panel and mounted in the cabinet, we have reproduced it full size so that this may be cut out and used as a temporary measure, to facilitate alignment. To do this, cut out the scale, with as much overhang at each end as possible. Using some cellulose tape, string the scale midway between the two meters, so that the distances from each extreme of the scale to each meter are equal. Close the gang and fit the dial pointer so that it is a line thickness to the left of the "88" line on the scale. The clamp of the pointer is fitted to the cord at this point.

Before starting adjustment and alignment, set the switches to "AM" and "Sharp". Set the three trim pots to about mid travel and set the three AM gang trimmers to about one quarter in mesh. Switch on and check the supply voltage. Ours came to 11.4V and yours should be within about 0.5V of this.

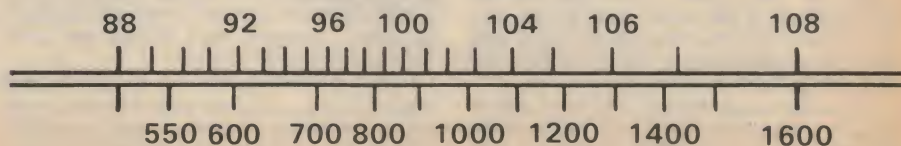
Before tuning in a station, adjust the 1k trim pot so that the signal meter reads zero. Lift one side of the 18pF capacitor under the second IF transformer and tune in a station. It may not be very strong but it will more than likely give some reading on the signal meter. Adjust the slugs in the last IF transformer and each one in the first IF transformer pair for maximum response. It is essential to get all these tuned circuits on the same frequency as the ceramic filter. While making these adjustments, rock the tuning to make sure that you are getting the maximum response possible.

Under no circumstances must the tuning be altered from the present setting for the rest of the IF adjustments. Solder the 18pF capacitor back on the second IF transformer. Connect a resistor with conveniently short leads across the secondary of the second IF transformer. The resistor may be any value between 4.7k and 10k. Adjust the slug of the transformer corresponding to the primary winding for maximum response. Change the resistor over to the primary of the transformer and



Above is the PC board pattern, reproduced actual size to facilitate tracing. Full scale reproductions of the IF strip PC board and the FM front end PC board were given in the July and August issues respectively.

Below: this actual size reproduction of the dial scale is used to facilitate alignment, as detailed in the text. Take care to ensure that the dial scale is centrally located between the two meters.



PLAYMASTER 146

peak the slug in the secondary winding. Then remove the resistor.

Now switch to the "Broad" selectivity position. Connect the same resistor across the secondary of the first IF transformer, which is the same as the second IF transformer just aligned, and adjust the slug of the primary winding for maximum response. Repeat the operation by connecting the resistor across the primary and adjusting the secondary slug for maximum response. Remove the resistor, and this completes the alignment of both IF channels.

Switch to the "Sharp" selectivity position again. Tune to a station as near as possible to 600kHz and if it does not fall on the correct place according to the calibration, the slug in the oscillator coil must be adjusted until this is achieved. Adjust the RF coil slug for maximum. To adjust the aerial loopstick, the coil must be moved along the rod. Avoid touching the top, or gate end of the coil, as this will cause detuning. With a non-metallic tool, or fingers at the earthy end of the coil, move the coil for maximum.

Now tune to a station around 1300kHz and check for its correct place on the dial. This may be adjusted with the trimmer corresponding to the AM oscillator section of the gang. The other two AM trimmers are now adjusted for maximum response. Return to the low frequency station and adjust the slug again in the oscillator coil, followed by the RF coil and aerial rod. The high frequency station is checked in the same way and this procedure is continued until adjustment is complete.

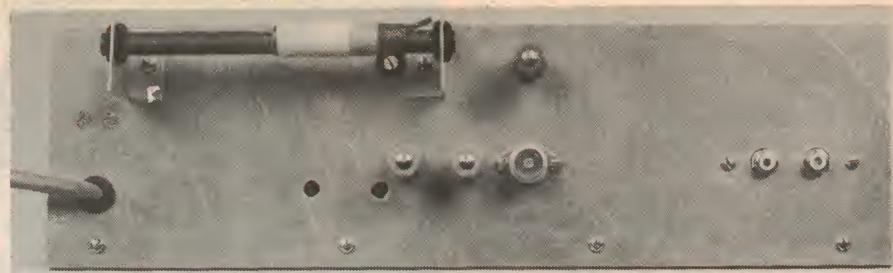
Adjustment of the whistle filter coil is best done with the help of an audio generator, a frequency counter and a CRO or audio millivoltmeter. There are two small white dots, one each on the two halves of the pot-core. Adjustment is effected by grasping the top half with the fingers and rotating it slowly. It should not be necessary to make more than one quarter of a turn either way, to adjust for a null. Maximum attenuation is achieved by adjustment conjointly with the 47k trimpot.

If you have the equipment, a precise 10kHz may be fed into the Darlington pair, by lifting the .01uF input capacitor and then adjusting the whistle filter for maximum attenuation. For readers who are less fortunate and do not have such elaborate equipment at their disposal, the other method is to do it by listening. This will be done at night and with the selectivity switch set to "Broad" and tuned to a station on which there is a high level of 10kHz whistle. The coil and 47k trimpot are adjusted as described, for maximum attenuation.

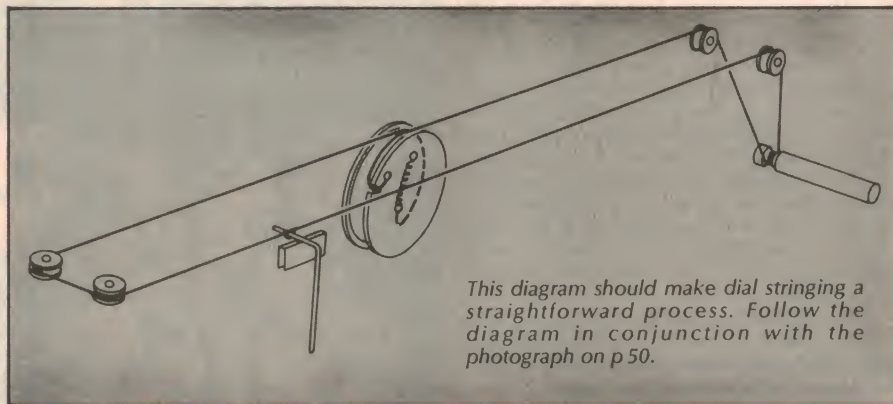
Although the circuit values given should make the correct adjustment possible, due to some component value spreads, it may not be possible to get the required adjustment. In fact, we ran into this problem on one occasion and a cure was effected by adding a 330pF capacitor directly across the whistle filter coil. This value may vary from one case to another and is mentioned as a guide only.

The 820 ohm resistor determines the full scale reading of the signal meter for the AM tuner. This value may be varied if the needle travel either falls short, or hits the stop, under very strong signal conditions.

The audio output trimpot may need adjustment to avoid overloading the input of the amplifier or control unit. A desirable setting



Above: the rear panel of the Playmaster 146. Left and right screwdriver holes are AM audio level and whistle filter trimpots respectively. The two terminals and the coax socket are for FM balanced and unbalanced feeders respectively. The terminal above the coax socket is for an external AM aerial (if needed). The audio output sockets are at extreme right, paralleled for AM and providing left and right stereo outputs for FM.



This diagram should make dial stringing a straightforward process. Follow the diagram in conjunction with the photograph on p 50.

would be such that the audio level from the AM tuner is the same as that from the FM tuner.

Details for the alignment of the FM tuner have already been given. However, there are some finishing touches which may be done now, which could not have been done earlier. There has been a modification to the use of the signal meter on the FM tuner. We found that a 5.6k resistor was just right to give a zero reading on the meter, with no signal being received. This may need some slight change and must be dealt with in each individual case.

Now that we have the scale for the FM tuner, it is possible to touch up the alignment so that the frequency of the stations received will fall at the correct place on the dial. If you do not have an accurately calibrated VHF signal generator, a signal of known frequency may be used for the low frequency end of the band. If you are fortunate enough to be able to tune the sound of TV Channel 5A, then this will give you an accurate 107.75MHz. Failing this, the next available frequency should be used.

For readers who wish to duplicate the wooden cabinet, a few guidelines may be helpful. The woodwork consists simply of a sleeve consisting of four pieces. The basic wood is 3/4in particle board and the pieces are cut so that they are butt jointed, tacked with panel pins and glued with PVA glue. The inside dimensions are 317mm long, 90mm high and 178mm deep.

The box is finished with Queensland walnut "Thermo" veneer. This veneer is obtainable at most hardware and timber merchants. It is pre-glued and it is fixed simply by ironing it on with a domestic iron. Details are given with each sheet of veneer.

So that the front panel may be fixed to the cabinet, a step is required around the four front edges. The step is about 8mm wide and about 2mm thick. It must be covered with the veneer,

which is much thinner than the required 2mm. We solved this by using strips of cardboard, covered with the veneer, the combination then being glued in place with PVA glue. Make sure that the inside edges which will later take the front panel, are quite straight, otherwise cracks will spoil the final appearance.

The front edges are also veneered and in order to give that professional appearance, the corner joints should be chamfered at 45 degrees. All this may seem rather tricky, but with care and patience it is possible to come up with a cabinet which rivals the commercial ones.

Finish is a matter of personal choice. Some may prefer French polish but for the novice, this could cause some problems. A finish which is easy to do and which gives pleasing results is the Scandinavian oil finish. The materials for this are available at hardware and paint stores.

Only after the cabinet has been finished can the front panel be fitted. This is offered in through the back of the cabinet, carefully set in place and fixed with a fillet of PVA glue right around the edges. The cabinet is best left face down for this operation and until it is dry.

The complete tuner assembly slides in through the back and butts up against the front panel at two points. The tuner is held in by four screws, with rubber feet attached. Four holes must be drilled in the bottom of the cabinet, corresponding with the holes in the runners of the tuner assembly. This operation calls for care and accuracy and it is a good idea to drill oversize holes in the cabinet. We made ours 1/4in diameter.

With all this done, you will now have a tuner system which you should continue to derive much pleasure from for many years. At the time of writing, all we need now is a good FM broadcasting service! By the time this appears in print, let us hope that the ABC and some others will have made an appearance, or are well on the way.

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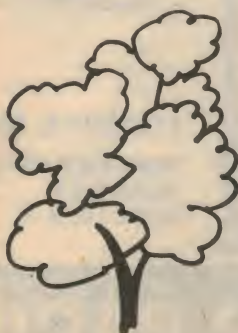
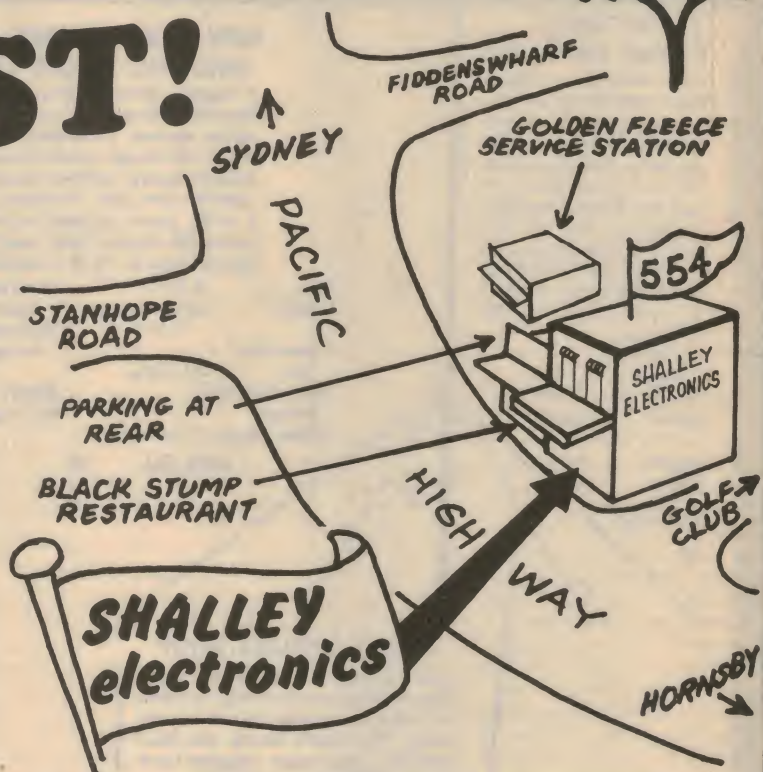
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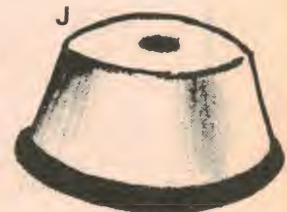
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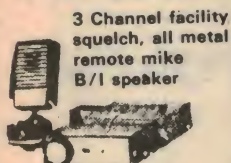
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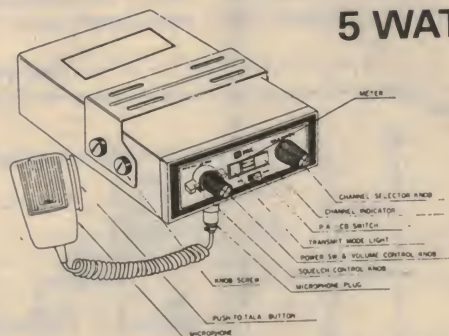
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Sustain unit for guitar amplifiers

Circuits which produce special effects or deliberate—but legitimate—distortion of signals from guitars or similar musical instruments are always popular with modern musicians. The sustain effect, plus some "colouration", is one of the more popular ones and this article describes a simple circuit to provide it.

by G. T. RYAN*

This is a device used to effectively lengthen or "sustain" the duration of a musical note. It is used by guitarists wishing to add emphasis to particular notes or chords.

Fig. 1 shows the decaying waveform (damped oscillation) obtained from a guitar string. Once having been plucked, a string will theoretically maintain oscillation indefinitely but, in practice, it is damped and the amplitude decreases with increasing time.

The rate of decay of the damped oscillation depends upon the loading of the string. Generally, higher quality strings will decay at a slower rate but this is also dependent upon the type and quality of guitar being used.

Sustain units consist of a high gain amplifier followed by a clipper to limit the maximum output voltage. In this way the amplitude at 't₂' (Fig.1) is raised to the required output level while the amplitude at time 't₁' will be limited to the same output level. (Fig. 2)

Clipping the waveform distorts the original note and, if applied to speech or complex musical chords, would produce intolerable distortion. But, used with a guitar, the added "colouration" of the musical notes is sometimes just what the guitarist wants. To produce a sustain unit



FIG. 2

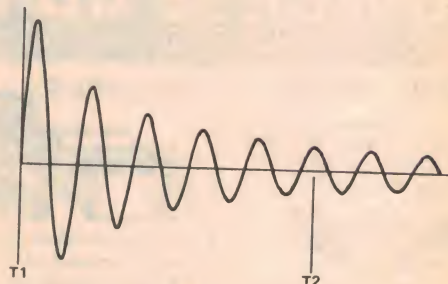
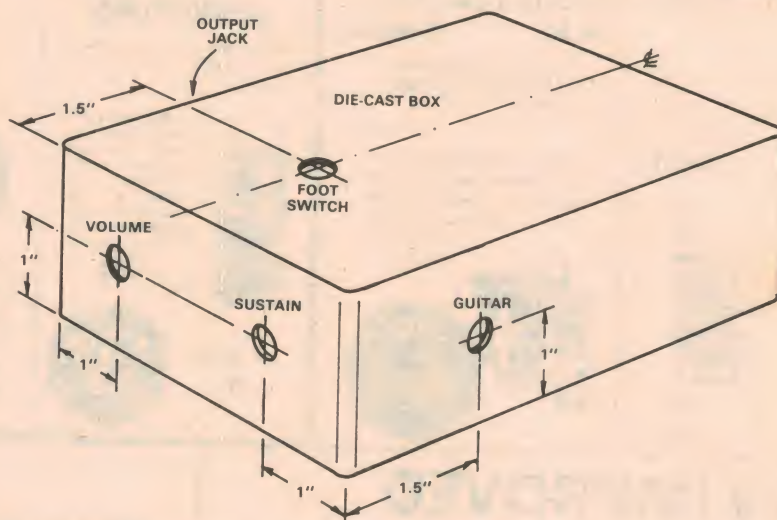


FIG. 1

Fig. 1. (Above) The decaying waveform from a plucked guitar string.

Fig. 2. (Left) The same waveform held at a constant (lower) level by clipping.



The entire unit is housed in a die-cast box which is robust enough to carry the foot switch and withstand the kind of treatment which this implies. The unit carries its own battery and is switched on by inserting the input jack.

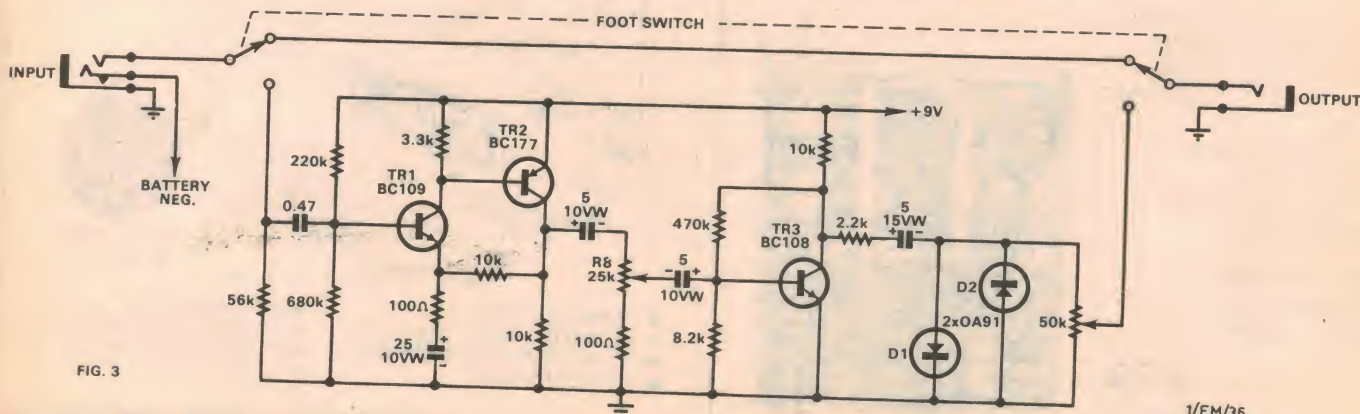


FIG. 3

1/EM/36

that did not distort would require a much more complicated and expensive approach.

Fig. 3 shows a practical circuit. Transistors TR1 and TR2 are used in a pre-amplifier circuit that provides most of the unit's total amplification. R8 controls the total gain and so controls the amount of sustain. Maximum gain will produce maximum sustain. Transistor TR3 further amplifies the signal which is then applied to a diode clipper circuit, D1, D2. Inserting the guitar plug into the input jack provides the chassis return for the 9 volt battery, and no other switch is used or required.

PLEASE NOTE

This project is one contributed to our Kits-EA Competition. As such, it has not been through our laboratory and should not be regarded as a regular "Electronics Australia" project. We will therefore not be in a position to answer postal queries about its operation, or supply back-up information, diagrams, etc, beyond what is published. And while we may quote the contributor's name and address, to authenticate the article, the contributor is under no obligation to answer letters about his project. That is entirely a matter of his own inclination and convenience.

A die-cast box (6in x 4in x 2in) was used as a case for the unit. The lid was used as the bottom with four small rubber feet attached. The two controls are at the front, the input jack on the left, and the output on the right. The foot switch is in the middle towards the front, to provide a rest area for the foot.

The case can be spray painted any desired colour. The components may be mounted on matrix board or a printed board which can be positioned between the ledges inside the box.

Adjustment involves three steps. First, set the guitar amplifier level and the guitar volume with the sustain unit bypassed. Then, operate the foot switch, set the sustain level about half way, and adjust the output volume control for the same loudness as in the first instance. Finally, adjust the amount of sustain required by striking a note or chord. After some practice with adjustment and musical arrangements, the guitarist will find conditions that suit his taste.

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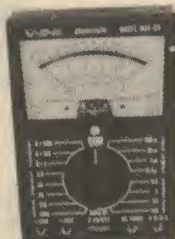
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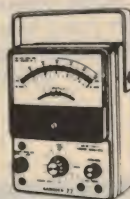
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EA 9/15

New kit teaches digital concepts to tyros

When the staff at Virginia Polytechnic Institute in the USA were faced with the problem of teaching digital systems concepts to chemistry and chemical engineering students, who lacked any background in electronics, they developed a rather unique teaching kit.

by JAMIESON ROWE

Electronic measurement and control techniques are now an integral part of chemistry and chemical engineering, as they are in many other disciplines, and students in these fields need to have a good grasp of the concepts involved. This can pose a problem, because such students often have no background in basic electronics.

The traditional approach has been to try and provide a basic electronics background, but this is time consuming and hard to justify for people who want to become chemists or chemical engineers, not electronics experts.

Virginia Tech faculty members Peter Rony and David Larsen were faced with this problem, but saw an answer in the trend towards digital technology. They reasoned that it should be possible to leapfrog the traditional approach, and teach digital systems concepts without worrying the students with detailed electronics theory. In short, they decided to present digital concepts in functional terms, divorced from circuit operation.

The system they developed to do this was a kit of small PC-board modules, designed to plug into the well-known SK-10 breadboard socket made by E-L Instruments Inc., of Derby, Connecticut. Known as "LR outboards", the modules are now being manufactured by E-L instruments, and sold together with a power pack and breadboard base as a complete teaching system.

To date some 8 LR outboard modules have been released, including a logic switch module, a clock oscillator, a 7-segment display with decoder/driver, a LED lamp monitor, a dual pulser, a programmable timer/counter, and a universal module to take any DIL package IC. The power pack unit has current limited and regulated 5V and bipolar 15V supplies, as well as bipolar 24V and 10V AC unregulated sources.

Future outboards planned include a set to assemble a complete microcomputer system, and modules for data communication. The microcomputer set is due for release shortly.

Each of the outboards consists of a small PC board fitted with pins, to mate with the holes in the SK-10 socket. The

pins automatically perform connections for both the power supply and logic of the outboards, and also provide physical support. This permits very rapid and simplified assembly of systems.

To accompany the system, Larsen and Rony have written student laboratory manuals, which they have dubbed "Bugbooks". Bugbooks I and II are currently available to cover the modules released to date; further volumes will follow to cover the microcomputer and later outboards.

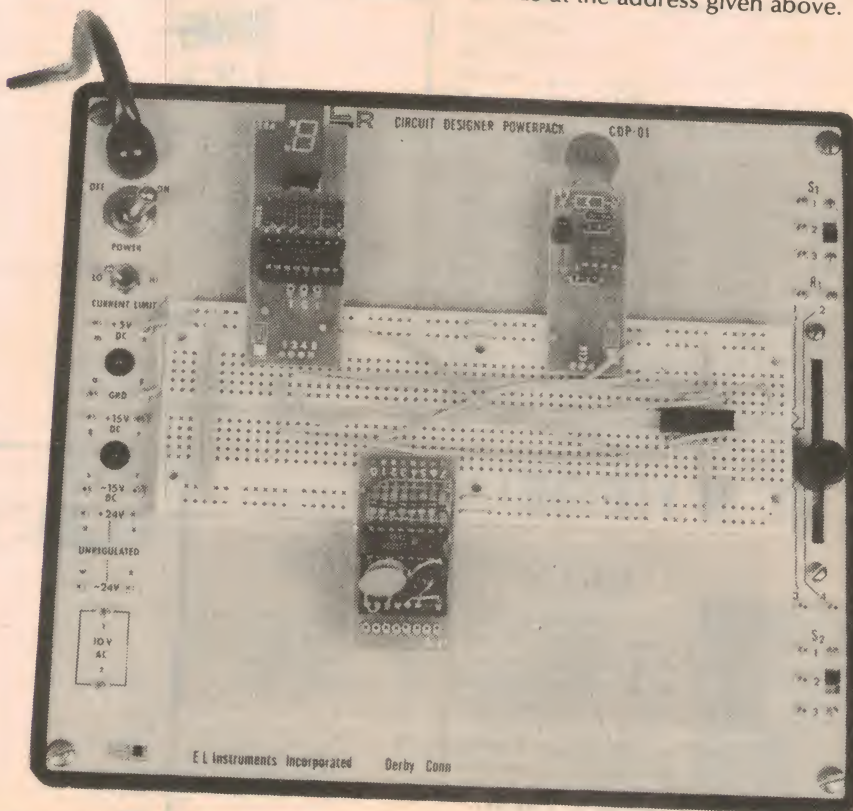
The books are very detailed, and take the student very thoroughly through the concepts of digital element and system operation. They have been published by E-L Instruments, and are being marketed as an integral part of the LR system.

Since the LR system has been produced and marketed by E-L instruments, it has become quite widely adopted by US colleges and schools, and also by firms such as IBM for staff training.

In Australia, the system is handled by General Electronic Services Pty. Ltd., of 99 Alexander Street, Crows Nest, NSW 2065, who report that they have already found a very favourable response from local educators. Quite a number of kits have been sold to date, to both colleges and manufacturing firms. GES marketing manager Erle Goodwin says that lecturers, tutors and staff training officers have been quick to see the benefits of the LR system's integrated hardware-software approach.

Price of the complete kit, including power pack unit, SK-10 socket, a full set of outboards with ICs, passive components and connecting wires, and the Bugbooks I and II, is \$315.00 plus tax if applicable.

For further details, readers are referred to GES at the address given above.



The LR powerpack unit with a single SK-10 socket, three of the outboard modules and a 14-pin DIL integrated circuit wired together.

C&K Switch Selector

The switch is to C & K because switches from C & K Components, Inc. (USA) are superior in every design aspect through engineering know-how and experience. Quality, craftsmanship and care make each of these switches a precision component.

The types illustrated are simply a basic cross section of the range available. The range embraces the widest possible variety of switch combinations to meet every requirement . . . Toggles, Rockers, Illuminated Rockers, Paddle Handle, Pushbutton.

Miniature, subminiature and microminiature sizes in many circuit/position configurations are available in one, two, three and four pole models. All switches feature rugged construction and simple mounting . . . long-term, trouble free operation is ensured.

Toggle switch contacts are rated 2 amps @ 240 VAC and 5 amps @ 28 VDC resistive load.

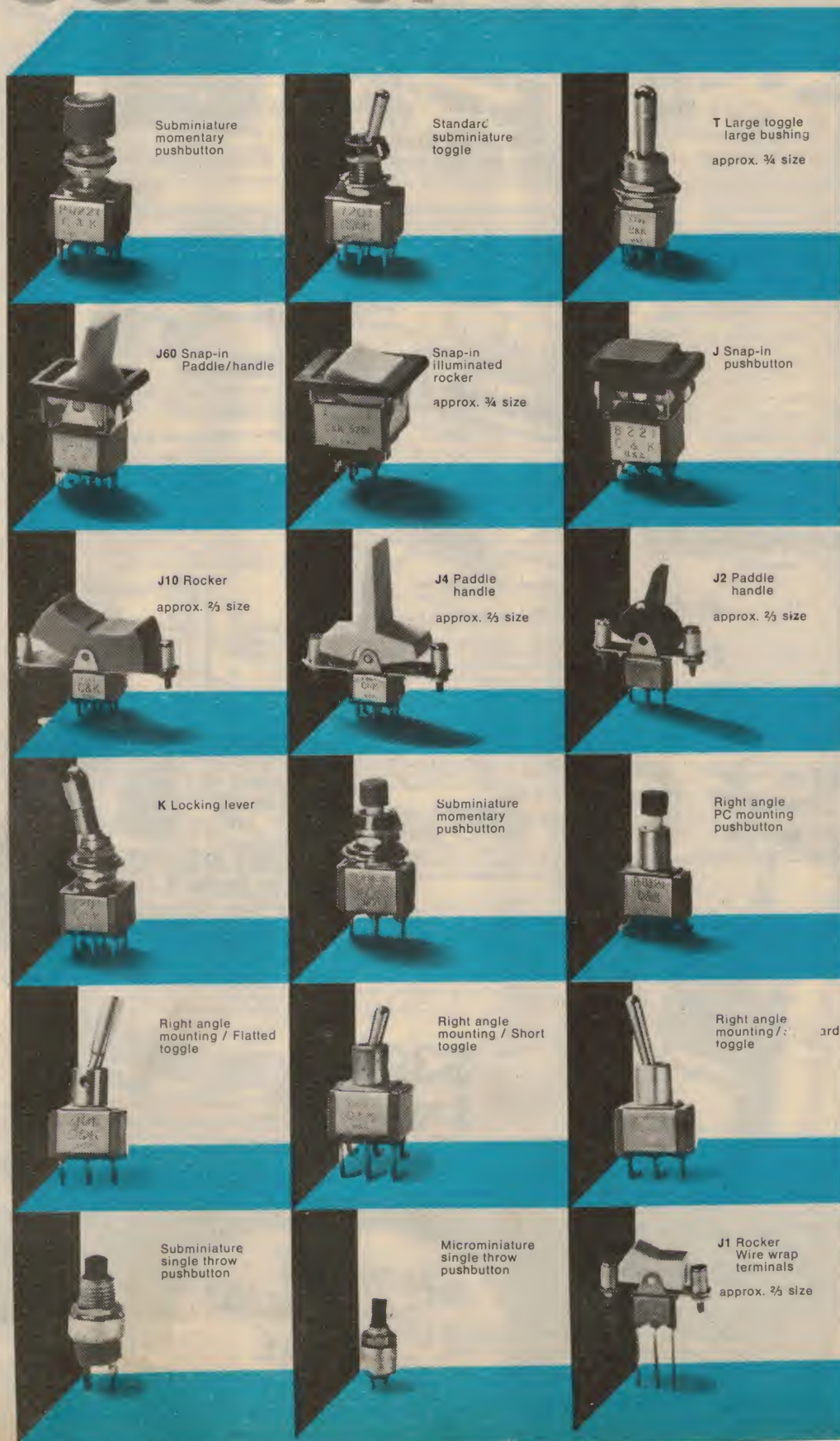
A catalogue containing full specifications, options, mounting information, panel layouts, etc., is available on request.

PLESSEY

Plessey Australia Pty Limited
Components Division

Box 2 PO Villawood NSW 2163
Telephone 72 0133 Telex 20384

MELB.: Zephyr Products
Pty. Ltd. 56 7231. ADEL.:
K. D. Fisher & Co. 223 6294.
PERTH: H. J. McQuillan Pty.
Ltd. 68 7111. N.Z.:
Henderson (N.Z.) 6 4189.



tear out and keep for easy future reference

JUST IN

CAR CONVERTORS

24V to 12V For 24V vehicles and boats to operate 12V car stereos, radios or transceivers from 24V d.c. supply. Output is 12V 2A with 3A surge. Was \$29.50 Now \$22.00 (p&p \$1.00)

12V to 6V For VW owners to run 12V radio etc from 6V battery. Saves cost of 6V radio! Provides 12V 2A (3A surge) from 6V d.c. supply. Was \$29.50 Now \$22.00 (p&p \$1.00)

FANTASTIC XEON FLASH TUBES

New Low Prices
 MF1210 Tube - normally \$4.54. NOW \$2.00.
 TRAKM Transistor - normally \$3.40. NOW 90c
 QUANTITY ENQUIRIES WELCOME



BIG DICK POWER SUPPLY
 So many people have been asking for a bigger supply than our popular Dick. So here it is. Two ranges 0-12V-24V with a max. current of 1.5A. 3 transistor 7 diode circuit with meter readout of Voltage and Current. Voltage selector and variable control. Measures 18.5 x 10.5 x 8.5 cm weighs 1.5 kg (it's that well made!) Specially designed for instrument supply and the service bench. Fully regulated. Simply connect leads directly into Big Dick or mount and connect terminals supplied. Value at \$39.50

\$39.00
 p&p \$3.00

SUPER-SENSITIVE METAL DETECTOR

Just tell a builder or handyman about this fantastic gadget - it locates any metal object: wire, pipes, reinforcing steel, even nails, inside walls and plaster etc.

- Light comes on in presence of metals
- Penetration sensitivity control locates metal 6' away
- Supersensitive electronic circuit pinpoints even small nails
- Easy to operate from 9V transistor battery

Range depends on size of metal object. Ideal for electricians who once had to pay \$30-\$40 for such a unit. And only... (9V battery 75c extra)

\$6.90
 p&p 75c

Try one on the beach - you could find a fortune!

HUGE SAVINGS ON TRANSFORMERS

D.S.E. "EICO" Transformers

Manufactured for Dick Smith Electronics. Full satisfaction guaranteed.

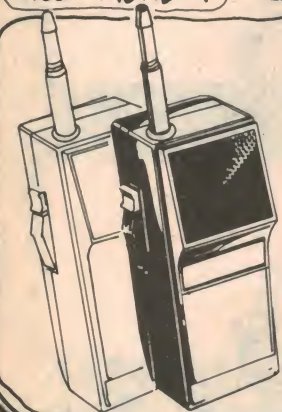
DSE 2851 240V AC to 12.6V @ 15A. Center tapped. Normally \$6.50 Special \$3.50 P&P 50c **\$3.50**

DSE 2155 240V AC to 6.3 7.5 8.5 9.5 12.6 15V @ 1 amp. an ideal multi purpose power transformer. Normally \$6.50 Special \$4.75 P&P 50c **\$4.75**

DSE 6672 240V AC to 30 27.5 24 20 17.5 15 @ 30V C.T. @ 1 amp. Normally \$11.00 Special \$6.50 P&P \$1 **\$6.50**

DSE GIL 2 240V AC to 18 volts @ 6 amps. Designed for 13.8 volt DC inverter, wipers and battery chargers. now C. current \$14.50 P&P \$1

look out for our MINI-CAT next month!



TREMENDOUS LOW PRICE WALKIE TALKIE OFFER

CONTACT CT10
 Remember the famous Midland 137000 units in our last year's catalogue? We sold thousands of these units (no wonder when you read the spec). The Midland is no longer available but we have located an absolutely IDENTICAL Unit. ONLY THE NAME HAS CHANGED. Check these features:

- Provision for 2 channels (27.240MHz or 27.880 MHz). Tuned RF stage.
- One microvolt sensitivity. Mute control. Calling tone. Heavy duty aerial.
- Maximum power allowable. PMG APPROVED licence required.
- Transmitter effectively converts its 1W output power into a high ratio output power by high level push pull class B modulation. Rugged case. Supplied with one set of crystals (specify frequency). Other frequency available at \$4.50 per.
- Range: up to 10 miles depending on terrain up to 50 miles over water
- Frequency: 27.240 or 27.880 MHz
- Freq. Stab: 0.005%
- Tx: Crystal controlled 1W
- Rx: Crystal locked superhet
- Antenna: 13 section telescopic
- Power: 8 x 1.5V UM3 cells
- Size: 8 1/2 x 3 1/2 x 1 1/2
- Weight: 250g

We have the Contact CT10 at the same, YES SAME price as our old catalogue. It must be the cheapest, 1 Watt, fully approved unit in Australia at ONLY \$39.95. Buy 5 or more and save \$2.00 on each unit at only \$37.95 (P & P \$2.00 per unit).

\$39.95 each
\$79.90 pair

SPECIAL NI-CAD BATTERIES

Standard Pen-Lite Cell size & RECHARGEABLE!
 Normally \$2.25 ea
 Now **\$1.75** ea
 (1 for 1.50 (gives 12 Volts))



"Very good value indeed" Neville Williams, Electronics Australia, Feb. 75

Don't take our word for it, see the review in Feb. E.A. The Echosound Tuner is incredible value for money. Has separate AM and FM front ends. 10 transistors and 14 diodes. Covers FM 88 to 108 MHz AFC. 60db S/N. 35 db spon. 600mV output AM 535 to 1605KHz, ferrite rod antenna. Features multiplex adaptor complete with built in stereo indicator. 240V operation. Complete in Walnut case. Guaranteed for 12 months.



AM, FM STEREO/MONO
Fantastic F.M. Tuner
 SAVE \$10

PH58 INDOOR/OUTDOOR PAGING HORN Here's a real de luxe Weatherproof Horn Speaker with instant metal horn. As used extensively in factories etc. Handles 150W peak and matches 8 16 ohms. Frequency response from 360 - 10000Hz with a special rubber ridge clamping to eliminate resonances. Complete with bracket and measures 5" x 8"

highly recommended at **\$22.50**
 p&p \$1.75

KIT VERSION \$34.50
FULLY BUILT & TESTED \$37.50
 p&p \$1.00

Yes! bulk buying enables us to reduce the price by \$12.00

PROFORDS CLOCK NOW IN KIT FORM!
 An incredible clock, the DCB has everything Big Bright gas discharge display of hours minutes and AM PM. Auto-zero on switch on. Separate push buttons for setting hours and minutes. Plus hold for 24 hour setting. Electronic alarm gives 7 minute cycle. 240V basis. Snooze facility gives 7 minute cycle. 240V operation. Build it yourself or get one ready made for only \$37.50.



NOVUS 4510 MATHEMATICAL CALCULATOR



Features Reverse Polish Notation, 3 level stack plus separate accumulating memory display, 8 digit memory, 8 digit display, Logs, antilogs, sine, cos, tan etc, square root, squares, squares.pl, reciprocals. We can't do it justice here so call in or see one or check page 59 of our new Catalogue.

NEW LOWER PRICE **\$59.95**
 SPECIAL TAX FREE PRICE **\$54.00**
 (P & P \$2.00)

GUARANTEED FOR 12 MONTHS

4515 PROGRAMMABLE (Similar to above)

NEW LOWER PRICE INCLUDES NI-CAD BATTERIES & RECHARGER **\$99.95** P & P \$2.00 A DROP OF \$46.00 !!

TAX FREE PRICE (B968) **\$89.00** P & P \$2.00

MINIDRILL

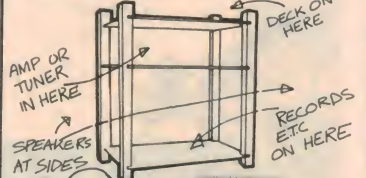
PC drill runs off 4 UM3 cells or 6V dc at 600mA runs at 2500 rpm drilling holes from 0.0236 to 0.059". Ideal for all PC drilling, model makers, jewellers. This is a new line at \$15.75 (P & P 75c).



AND NOW...

STD-50 MINIDRILL STAND
 Make your own mini STAND DRILL
 Only \$8.50 (P & P 75c)

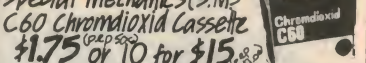
AUDI PAC STORAGE UNIT
 Ever wondered where to put your hi fi gear? Well, here's the answer - an easily assembled unit to take turntable/recorder, amp/tuner etc, as well as your records!! Comes pre-cut, drilled with screws, instructions etc. Packed ready to take home and so simple to assemble. Just think of the time it saves you building something yourself. Finished in expensive darkwood. Measures 22 1/2" W x 15 1/2" D x 25 1/2" H (outside measurements) and takes turntables up to 19 1/2" W x 15 1/2" D, amps up to 6 1/8" H. Excellent value especially for home brews. (Gives that expensive bought look!) \$29.95 (p&p \$2.00)



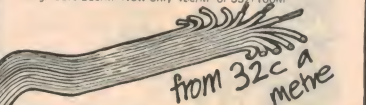
Typical system built around the **AUDI PAC UNIT**

LOOK AT OUR PRICE for genuine B.A.S.F. Special Mechanics (S.M.) C60 Chromadioxid Cassette

\$1.75 (p&p 50c) **or \$1.50**



RAINBOW CABLE Ideal for looms. Flat multicore cable with 12 color-coded strands banded to form flat cable - Use it to pass intercom cables under carpets etc. Normal hook up wire rating. Save 20c/M. Now only 45c/M or \$32/100M

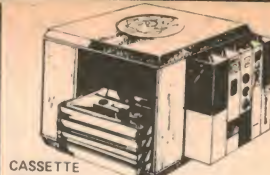


from 32c a metre

MODEL FS-30 15 Watt SOLDERING IRON

This fantastic little iron operates from any 12 volt AC or DC source (car battery or 12 volt 1.2 amp Transformer. Complete with plated tip, & 9ft lead. Ideal for Transistor servicing & general home repairs

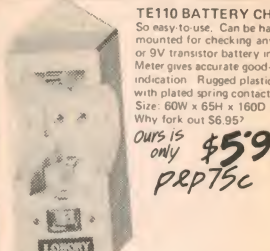
\$3.90 p&p \$50c



CASSETTE HOLDER

Keeps 'em handy and saves losing your favourite recordings. Holds cassettes in or out of cases. Spring grips prevent them sliding out. 15cm cube with revolving base and timber look finish. Capacity 32 cassettes without case or 20 in cases.

3.99
 p&p \$1.0



TE110 BATTERY CHECKER

So easy-to-use. Can be hand held or wall mounted for checking any 'C', 'D', 'AA' or 9V transistor battery in an instant. Meter gives accurate good-marginal-led indication. Rugged plastic construction with plated spring contacts for long life. Size: 60W x 65H x 160D mm. Why fork out \$6.95?

Ours is only **\$5.95**
 p&p 75c

NEW FIBREGLASS MINISWITCHES

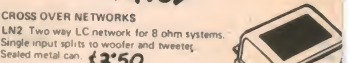
L1030/60 Lever Switch. 2 pole 4 position gives amplifiers etc. that expensive imported look. Supplied with black knob. \$3.75.



MR-204 Mini-rotary switch is fully sealed, again 2 pole, 4 position with only 1/2" diameter. Rated 240V a.c. 1A. Complete with smart black pointer knob for only \$3.90.

STEREO Lpad LP50S
 Better than a rheostat, this has two double element ganged rheostats wired around 10W peak rating 8 ohm. Ensures constant match with attenuation from 30db to 0.5db. Complete with instructions and 3/4" bushing for speaker mounting. Use this to extend your Hi-Fi speaker system properly.

CROSS OVER NETWORKS
 LN2 Two way LC network for 8 ohm systems. Single input splits to woofer and tweeter. Sealed metal can. **\$3.50**



LN3 As above but for 3 speaker systems **\$4.50**

WIRE, SPAGHETTI & ELECTRO PACKS

WIRE PACKS
 In response to numerous requests - ideal for servicemen, experimenters etc. Bag contains 2 metres of each of 12 different colours 0.12 x 10 hook up wire. Yes, that's a total of 24 metres for only \$1.00!

SPAGHETTI PACKS
 Another popular pack containing assorted colours and diameters. In all 30 lengths all around 6". Just what you've been looking for and just \$1.00.



ELECTRO PACK
 Yes! Dick's done it again. Resistor packs, capacitor packs, and now a GIANT 70% saving on brand new top quality axial lead electros. Listing from computer is based on USEAGE not USELESS values!! 50 caps for only \$5.00. Check the list:

10V	2x22, 1x47, 8x100, 15x220, 1x470
16V	2x100, 2x220
25V	1x10, 2x22, 1x47, 3x100, 2x220
50V	1x1, 1x2.2, 2x4.7, 2x10, 1x22, 1x10, 1x220

See 50 USEFUL values (some worth 70c each) yet average price is only 10c each. HURRY for these specially imported packs (not surplus) at only \$5.00 for all 50 electros.

CIGARETTE LIGHTER PLUG to suit 50c

SPARE TIP to suit 50c



NEW TAX FREE
 PRICE LIST NOW AVAILABLE
 SEND S.A.E



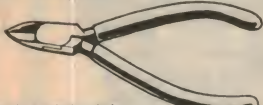
NEW TOOLS

FREE

SPECIAL TOOL PURCHASE

The search for new products is never ending and tools are one of the important areas we are constantly checking. Just look through this new range and their incredible low prices. It must all add up to good value. Especially with our FREE ultra-miniature screwdriver for those awkward grub screws (Just ask for one with any tool order - worth 50c!)

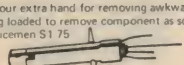
201 TRANSISTOR NIPPER for very small gauge wires. 4" (115mm) long. Spring opening insulated handles. Similar quality normally around \$7.00. Well worth \$3.50.



Handy Soldering Aids

P86 TWEEZERS with very fine, sharp, straight points and non-slip jaws. 125mm long. A must at only 65c (ideal for medical cabinet tool)

H3-C-R PULLER your extra hand for removing awkwardly located parts. Spring loaded to remove component as solder melts. Ideal for servicemen \$1.75



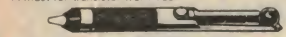
H9 SOLDER BULB A simple rubber bulb type solder sucker for de-soldering \$2.20.



H8 IRON TIP CLEANER reduces oxidation and prevents contamination of iron tip \$2.50



H72 HEAT SINK Like an alligator clip made of aluminium. A must for transistor work 75c



EL-1 SOLDER SUCKER Full metal construction - better than plastic! With Teflon tip. Simple push/release thumb mechanism. Comes with nozzle keeper (1) Normal price \$9.00. Now only \$7.50 (Spare Teflon tips \$1.50)



K88 NIBBLING TOOL cuts any shape opening in sheet steel to 0.6mm thick or light alloy to 1.5mm. Easy to use, cuts plastics too without distortion. Follows scribe lines easily. Our catalogue price is \$9.50. Now a bargain at \$7.50

HIMOUND HK705 MORSE KEY

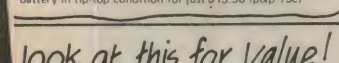
Unfortunately, the instructions are in Japanese, but we can tell from the diagrams that this key has real ball-bearing pivots which can be adjusted. It is beautifully made and a delight to handle. Heavy duty construction right through. Not a toy but a professional key. Screws adjust spring tension and knob travel. Measures 160mm x 90mm x 65mm high. Highly recommended for you CW enthusiasts

a professional quality key at \$19.75 p&p \$1



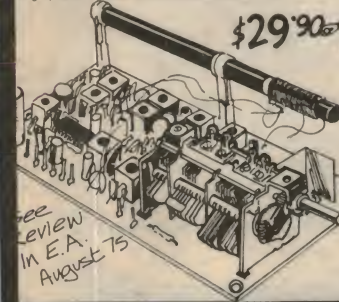
CHARGEIT

The neatest 12V, 1A trickle charger yet. Can be run continuously with special thermal-overload protection switch. Looks like a big mains plug with leads straight to battery. A handy unit for car, boat, caravan owners - keeps your battery in tip-top condition for just \$13.50 (p&p 75c)



look at this for value!

AM/FM MULTIPLEX TUNER YEX-601-1C
Here is the greatest tuner value you will ever see. Specially produced for Australia with 50µs F.M. de-emphasis (NOT the overseas 75µs). Has in-built ferrite rod for AM reception over broadcast band. 25db stereo separation. Pro'n for stereo licator IC Multiplex. Separate TUNED r.f. stage. Beautiful spaced AM/FM tuning gang covers full Australian AM/FM band width. Fully assembled at less than the value of the parts. Highly recommended at only \$29.90 (p&p \$1.00)



see review in E.A. August 75



NEW!

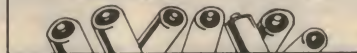
RANGE OF HANDY MODULAR PLASTIC COMPONENT BOXES FOR THE HOBBYIST OR HANDYMAN

Frankly, we have seen a lot of component drawers come and go over the years. In our opinion, these are the best ones that we have come across. Check these features. Large handle on the front of each drawer. Special index card slot moulded into handle for labeling. Outside of boxes have precision dovetail ways so that boxes may be securely fitted together. Wall or bench mountable. Trays do not seize inside box as many inferior other types do. Two types available. One with two drawers per box. The other unit has one drawer per box. All boxes in smart white high impact plastic with the drawers moulded in a smart red colour. Overall dimensions 5 1/8 in D. x 4 1/2 in W. x 2 1/4 in H. Price only \$1.00 each or 80c each 10 up (mixed.)

HUGE HI-WATT BATTERY SHIPMENT IN

Specially imported, factory fresh, high capacity, long life batteries. Just look at the savings

1050 D size metal jacket	Normally 30c	Now 20c	Save 10c
1035 C size metal jacket	Normally 25c	Now 15c	Save 10c
1015 AA penlite	Normally 20c	Now 10c	Save 10c
216 9V Transistor metal case	75c	40c	Save 35c



BURGLAR ALARM VIBRATION SWITCH (SAS 108)

Rugged little switch goes open circuit when it is shaken. Ideal for plateglass windows and safes etc. Adjustable sensitivity. Tamperproof case, rugged PVC case. 5W.50V/0.1A. Only 75mm x 85mm x 25mm \$2.00. Normally closed contacts.

MINI REED ALARM SWITCH (SAS 1)
Fully moulded in grey PVC with riveted case for extra security. Solderfree screw terminals. Complete with PVC encapsulated magnet. Normally open contact closes by magnet. Same rating as above. Get the pair for only \$1.50. 10up only \$1.30 (These were selling at \$1.90)



AND NOW... Dickwick! DESOLDERING DRY WICK

Desolders all sizes of Electronic and Electrical connections in one second without flux. All sizes of electronic joints and electrical connections, from integrated circuits and printed circuit boards to telephone connections, can be quickly, safely, neatly and economically desoldered with Dickwick and a regular soldering iron.

Now \$1.75 \$2.00

Another PC board BARGAIN!

This Silver Plated 'Design Board' measures 3 1/8 ins. x 5 ins. and consists of over 200 separate 'Lands' with over 400 separate holes (1 in grid) will take dozens of ICs and transistors and hundreds of components. Also has 4 x 1/8 in. mounting holes. Well worth \$3.00. Only \$1.00 each 10 up. 85c each. So buy now and save.

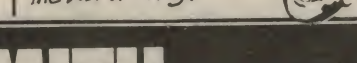
ONLY \$1.00 each

NEW FROM AWA

SOLID STATE CAR RADIO F.M. CONVERTER
This high quality compact unit enables your existing car radio to receive the new F.M. broadcasts WITHOUT complicated alterations or difficult installation. Simply mount in a convenient position inside your car and connect between antenna and radio with lead and plugs supplied.



While Inflation rages on - We've REDUCED the cost of living!!



DIGITAL WATCH

QUARTZ CRYSTAL DIGITAL WATCH with full L.E.D. Readout.
THE GREATEST HOROLOGICAL ADVANCE SINCE THE INVENTION OF THE CHRONOMETER The system excelled in accuracy only by the Atomic Frequency Standard!

Made by the famous 'NATIONAL SEMICONDUCTOR CORPORATION'
• Lights up like a Neon sign - Easy to read in the dark. • Time in minutes, and even seconds.
• No moving parts - Fully Electronic - Incredible 'Minute a Month' accuracy and reliability
• Complete with Battery and Band • Full 12 month guarantee

NOW WE CAN OFFER THESE WATCHES AT \$79.00
P & P (REG) \$2.00

FULL SATISFACTION GUARANTEED - MONEY REFUNDED IF NOT SATISFIED

NEW MIC'S

ECM1021 CONDENSER MICROPHONE OMNI DIRECTIONAL
Frequency response 20-18 KHz
Impedance 600 Ohms supplied with windscreen, 10 ft. cable and press to talk switch. Only \$20.00 P & P. 75c.
A must for high quality public address or paging systems - also ideal for amateurs.

DYNAMIC MIC SCOOP

Limited trial quantity of beat dynamic mics - type DM403. Looks just like the expensive ones used by TV personalities. Shiny silver finish, right over. Transformer built in to handle gives 50K impedance with -57db sensitivity. Has on-off switch, desk stand, mic stand adaptor and neck-tie fitting for hands-off use. Ideal for Groups, Clubs etc. Usual price would be \$14.90, but yours for only \$10.90 (p&p 75c).
(175mm long x 50mm dia). Supplied with removable lead.

MODEL E-80 GUITAR PICKUP

Just the thing to convert your acoustic guitar into an electric guitar. Smart black non reflective moulded case with volume control and strong steel clip to attach to soundboard. Comes complete with 1/4" phone plug and extra long lead. Measures 3" w x 2" d x 1 1/2" h. High impedance output suitable for most amps \$9.75 (P & P \$1.00)

TOWERS' INTERNATIONAL TRANSISTOR SELECTOR. (T. D. Towers)

Our latest data book from Foulsham has over 140 pages of computer listing (for the most up-to-date print out) of over 10,000 transistors - ratings, characteristics, identification, manufacturer etc. UK listing with addresses CV numbers etc. Essential for the professional or keen hobbyist. At \$11.25 (P & P \$1.00)

FANTASTIC BSR FULLY AUTOMATIC TURNTABLE PURCHASE

MODEL G11-302 (C141) with Ceramic Stereo Cartridge & Sapphire Stylus. 4 Speed, Cue & Pause lever, Bias Compensator etc. etc.
See our Catalogue Page 10 for full details
NORMAL TRADE PRICE \$49.00

HT100 B4 MULTIMETER

100k/V Overload protected. 9.5µA movement 10A a.c. and d.c. scales. Shockproof mechanism. Ranges Vdc 0-0.5-2.5-10-50-250-500-1kV V a.c. 0-2.5-10-50-250-1kV Adc 0-10-250µA -2.5-25-250mA -10A A a.c. 0-10A Ohms 0-20-200k-2-20 Meg. Normal price \$42.00. Another money saving offer this month only \$35.00 (p&p \$2.00)

\$35.00
This month only at this price!

SCOPE SCOOP SAVE \$33.00

If you're a keen enthusiast or professional, you're going to need a scope and this Trio job is ideal for so many applications. CO1303A is a 3" 15 MHz CRO with 20mV/am sensitivity. Direct input permits displays to 150MHz. We have made a huge \$10,000 purchase so we can pass a saving of \$33.00 on to you!! Normal trade price is \$192.00 but the CO1303A is yours for \$159.00 (Road freight \$6.00 extra). Special tax free price (B0051E) is \$144.00. ONLY WHILE STOCKS LAST SO HURRY. Undecided? See review in E.A. June 74.

\$159 save \$33 or TAX FREE \$144

almost Half price!

BSR

DICK SMITH

ELECTRONICS CENTRE

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A DOLBY CASSETTE DECK OFFER YOU SHOULD NOT MISS!

NATIONAL TAPE DECK
Don't miss this incredible NATIONAL DOLBY DECK RS269US. Check the features then see the price!

- Electronic speed control
- Super permalloy head for record/playback
- Ferrite erase head
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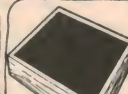
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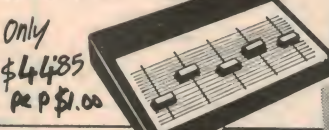


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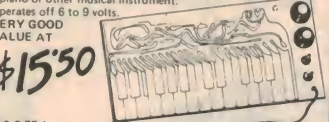
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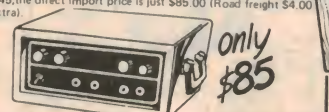


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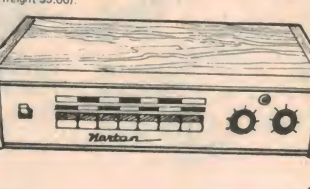
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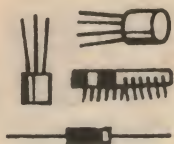
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What's new in Solid State

Dawn of the microprocessor era

Although microprocessors or "computers on a chip" have been around for about three years now, it is only in the last 12 months or so that they have really started to blossom. Almost all of the major semiconductor makers have now made an entry into the field, and there seems to be an accelerating stream of new and more powerful devices.

Not only this, but there is obviously a great deal of money and effort going into promoting the devices. Weighty tomes of systems planning and applications data are beginning to appear, and each maker is running seminars and lecture courses for designers and engineers of prospective customers.

If we at EA seem to have ignored microprocessors ("uP" for short) until now, it is not because we didn't think them important, nor because we weren't aware of the developments. Rather, it has been because we have quite frankly been bewildered by the sheer bulk of information. Where does one start?

After attending a few of the seminars run in Sydney recently, I still don't feel able to put the topic of the uP's into full perspective. However it does seem about time we said something about this important topic, so I'll try to pass on here some of the broad perspectives I've been able to form to date.

Perhaps the most obvious thing about uP's at present is that they're still quite a long way from being a complete computer on a chip. Most of them still need quite an array of associated devices, to provide such things as external ROM and RAM memory, data and address multiplexers, address latches, status registers, clock generators, bus drivers and so on.

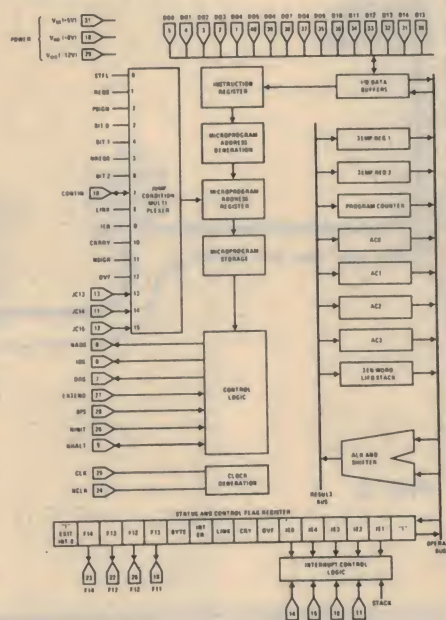
In general it is probably true to say that current uP chips provide most of the "central processor" or CPU hardware of a computer, apart from the memory: the main working registers, the arithmetic and logic unit ALU, and the timing and control circuitry. They also tend to include items like interrupt flags, and either a stack or a stack pointer register for handling interrupt and subroutine servicing.

Most of the makers have come up or are coming up with companion devices for their uP chips, to form complete system families. The companion devices include especially compatible ROMs and RAMs, addressable latches and bidirectional bus drivers, along with

functionally more complex things like a "peripheral interface adapter" (PIA) and an "asynchronous communications adapter" (ACIA).

Some of these devices are not very far behind the uP chips themselves in terms of chip complexity.

Perhaps surprisingly, many uP chips don't seem to lend themselves for easy use in general-purpose computing. With some chips it could well be a major job to produce an equivalent of the familiar



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by A. J. LOWE

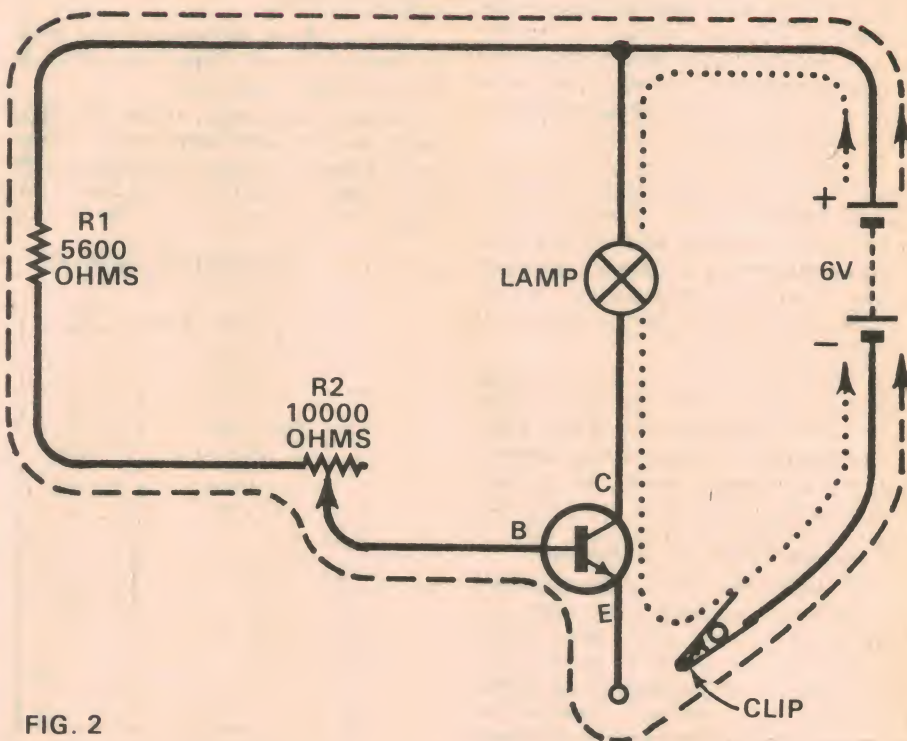


FIG. 2

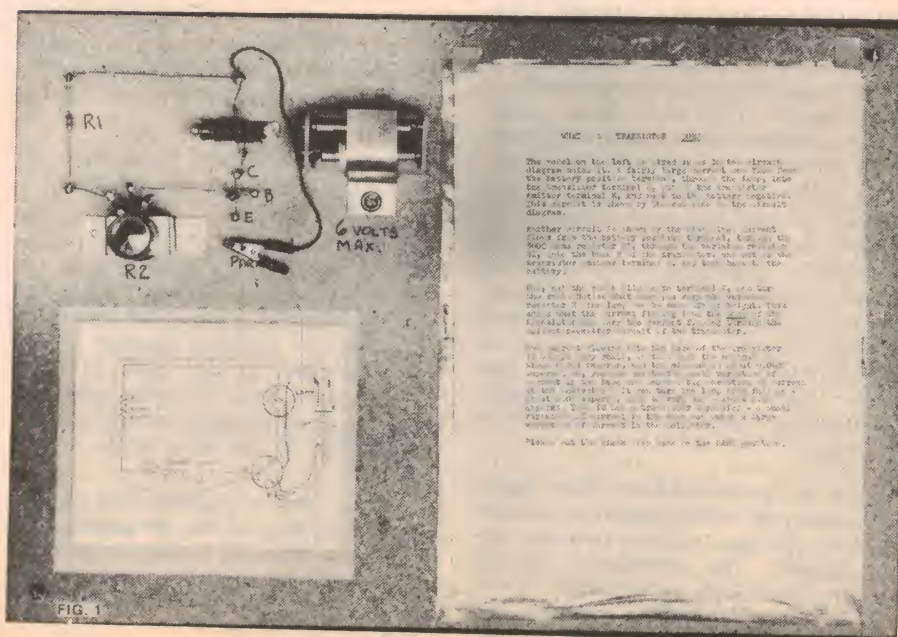


FIG. 1

WHAT A TRANSISTOR DOES

The model on the left is wired as in the circuit diagram below it. A fairly large current can flow from the battery positive terminal, through the lamp, into the transistor collector terminal C, out of the transistor emitter terminal E, and back to the battery negative. This path is shown by the dotted line in the circuit diagram.

Another circuit is shown by the dashed line. Current flows from the battery positive terminal, through the 5600 ohms resistor R1, through the variable resistor R2, into the base B of the transistor, and out of the transistor emitter terminal E, and back to the battery.

Put the clip on terminal E, and turn the knob. Notice that when you vary the variable resistor R2 the lamp can be made dim or bright. This shows that the current flowing into the base of the transistor can vary the current flowing through the collector-emitter circuit of the transistor.

The current flowing into the base of the transistor is always relatively small; in this case the maximum is about 0.001 amperes, and the minimum about 0.0002 amperes. So, you can see that a small variation of current in the base can cause a big variation of current in the collector—it can turn the lamp from full on—about 0.05 amperes—down to very dim—about 0.02 amperes. This is how a transistor amplifies—a small variation of current in the base can cause a large variation of current in the collector.

Please put the clip back in the "PARK" position.

This is the second in our series of "Teach Yourself Boards" designed to help beginners learn the basics of what common semiconductors and circuits do. A general account of the aims and construction of the boards was given in the first lesson.

This month's board, built on the standard 13mm chip board "chassis" measuring 450mm x 300mm x 65mm, tells the rudiments of "What A Transistor Does".

It was designed simply to get across the fundamental concept that the current through a transistor may be controlled by the current flowing through the base. Nothing more.

The layout of the board is shown in Fig 1, and the circuit in Fig 2. Note that in the circuit diagram on the board, broken lines are used to indicate current flowing through the collector-emitter circuit and through the base-emitter circuit. Also, the values of the resistor and the potentiometer are spelled out in full—not abbreviated to 5.6k and 10k.

Construction needs hardly any explanation. The pot was mounted on a "bridge" made of aluminium; the lamp

PARTS LIST

1 10k potentiometer
1 5600 ohms resistor (or to suit see text) ¼ watt
1 lampholder
1 lamp—6 volts about 60 mA
1 transistor BC108 or similar
4 AA cells
1 battery case and clip
1 crocodile clip, aluminium, nails etc.

holder was an ex-junk box. The battery comprised 4 AA cells in a suitable case, held in position by an aluminium clip.

The value of resistor R1 was found by test, so that the pot was fully effective—that is, it varied the brightness of the lamp over its full range. Thus when the pot R2 is set to zero ohms, the value of R1 should be selected so that the transistor will just saturate. Then any increase in base resistance, by turning the pot, will dim the lamp.

In our next lesson we will be looking at a board which demonstrates that most fundamental law of all electronics—Ohm's law. We have called it "Know Ohm's Law".

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Forum

Conducted by Neville Williams

Radio problem for small private boats

Much to our surprise, two full pages in the May issue on the subject of the Citizens Band hardly stirred a ripple indicating, surely, that much of the one-time emotion has been dissipated. But it did invoke one response which is important enough to warrant special mention: it involves a possible link between CB equipment and safety at sea.

The matter is raised in a letter from a Tasmanian reader, but his concern is by no means unique. Only a few weeks ago, the same series of questions were posed to me by a business acquaintance in Sydney facing what is, in fact, a very common situation. Here's the letter:

Dear Sir,

I read with interest your article about the Citizens Band, in the May issue of "Electronics Australia". The article encouraged me to come forward with the following problem:

I am not a radio man, but I would like to use a CB radio once a year during my summer holidays, on a small day-sailer, for the sole purpose of communicating with my family, as there are only a few telephones in southern Tasmania. It makes an otherwise enjoyable holiday a race with the time to reach a telephone, despite the weather, because I have agreed to ring home twice a week!

It would also add to safety.

When I approached a local specialist on radio communication, I was presented with so many "difficulties" and legal aspects, licences and what not to do, that I had to give up the idea.

My question is: Is that really so? Could I use such a CB transmitter with the knowledge that I can reach my family, say 60 or 70 miles... I beg your pardon: 100 km away, without having to use the bulky and expensive radio transmitters used by yachts or fishing boats? The trouble is, my home is 3 miles from the sea, in a gully between mountains, which I understand, will make the contact difficult.

How dependable is the claim by the salesmen: "... 50 miles over water?" If such a range is possible, what sort of CB radio would you suggest? The point is also, that intending to use it only for about 3 weeks a year, I would not like to spend a fortune on it. Am I asking too much?

(G.A.W. Hobart. Tas.)

Well...

The isolation—and more particularly the safety—of small boats at sea has been a matter for increasing concern over the past decade, with the emerging fashion to have one's own boat, with trailer, sails or outboard motor. While intended mainly for rivers, lakes and estuaries, a good many of these boats do head out to sea, on the assumption that the weather will hold and that nothing unexpected will happen.

But the unexpected can happen, and does happen, often enough to invite restrictive legislation and to make at least the more cautious boat owners wary of venturing "outside" without some kind of radio gear aboard. But now comes the problem, as set out in the letter—and it isn't unique to Australia.

U.S. authorities, for example, have been concerned for quite a while about what some U.S. writers have dubbed the problem of "rowboat radio"!

Quote from "APO News"

It's a bright, beautiful summer day. Thousands are on the beaches and in the water. Suddenly a swimmer is in difficulties. The helicopter patrolling overhead spots him and radios the surf life savers on shore.

Man drowning... urgent... urgent... But where? The pilot keeps repeating the exact location of the swimmer but his voice is drowned by childish chatter.

Some kids are playing around with a walkie talkie and they are having their fun and games on the same frequency as the life savers.

The pilot asks them kindly to get off the air. But they refuse, and in language that makes further entreaties pointless.

This happened in Sydney between Broken Bay and Wanda recently. Similar incidents have taken place in many other places too and there is a steady stream of complaints from legitimate users of licensed equipment that their operations—transport, building, fire fighting and life saving—are hampered by illicit operators.

Though obviously a cut above simple skiffs, the boats concerned may still be relatively small and relatively inexpensive: \$1000, give or take a few hundred. Compared with such a figure, it would seem reasonable to spend another hundred dollars or so on portable 2-way radio—roughly the price of a couple of CB units, off the shelf and ready to use.

The inquiry follows naturally: will these conveniently priced units meet the need and, if not, why not?

The short answer is: no and no again—relating to both practical and legal aspects.

In practical terms, the effective working range of hand-held CB units is both limited and variable because of their low power output, inefficient aerials and the dependence of the signal on environment at the usual 27MHz operating frequency.

The signals can be decimated by ignition or other electrical interference and I have seen hand-held CB units, in these circumstances, hard put to it to maintain a link beyond a few hundred yards.

Even in some quiet locations, say low bush scrub on relatively flat and dry sandy soil, they may be flat out to work over more than half a mile. But pick a path nearby, over water, and the signals may romp in from four or five miles away—provided neither party retreats from the water's edge!

Fifty miles over water? It might just be possible, given the most favourable possible propagation conditions, but for it to happen on cue is quite another matter!

If it doesn't, and if you can't rely on a 2-way radio circuit when you need it, there isn't much point in having it! As far as the present correspondent is concerned, my impression is that his local adviser has simply been honest and factual in discouraging him from relying on CB gear, either for personal communication or for safety at sea.

It might be argued that CB equipment would have to be better than nothing in an emergency and this may be true, provided absolutely no other reliance is placed on it. But, in the present case, absence of a radio signal would place Mrs G.A.W. in a real dilemma: the choice between initiating a possible false alarm or failing to react to a real emergency!

That the doubt surrounds a person on holidays, in a small boat, is not really relevant to the situation. The person concerned will not be any the less isolated on that account and, indeed, he may be in significantly greater danger from exposure and the difficulty of being spotted in any search.

In fact, contrary to the normal preamble to such inquiries, it could logically be maintained that, the less adequate the boat, the more reliable the radio needs to be!

What about higher powered CB equipment, with a whip aerial on the boat and something more pretentious again on shore? It would obviously be better than hand-held equipment but it

would cost a lot more and would still be subject to the propagation variables of the particular frequency. And, anywhere but in remote locations, the channel could be jammed at the shore end by local 27MHz "rag chewers". In fact, this is par for the course on the U.S. waterfront.

What about some other frequency typically in the 2-6MHz region? Here we run into more of the "difficulties" which G.A.W. has already encountered:

Firstly, CB equipment is only plentiful and relatively cheap because it has been mass produced for the 27MHz band. Equivalent gear for other frequency bands is simply not available at present.

But, even if it was, the HF spectrum is so crowded that there would be no hope of a private individual being granted an exclusive or even moderately shared frequency. Indeed, such is the crowding that, in Australia and elsewhere, all projected HF marine installations must be capable of operating in single-sideband mode, involving equipment which is inherently costly and expensive.

And that is not all:

As a matter of long-standing policy, the Australian Government has assumed the responsibility for operating the nation's on-shore and off-shore communications facilities, respectively through ATC (Australian Telecommunications Commission) and OTC (Overseas Telecommunications Commission). Individuals are expected to use these facilities (at the prevailing charges) wherever possible.

For its part, the OTC maintains permanently manned shore stations to handle emergency and regular traffic, with facilities to extend the communications net via telephone or telegram. Thus, while boats (small ships!) may conceivably use certain HF channels or even CB gear for purely ship-ship messages, all ship-shore messages should legally pass through the OTC/ATC facilities.

The main exceptions to this are fishing cooperatives, boating clubs, volunteer coastal patrols, etc, which may be licensed to operate a base station in addition to the mobile marine installations. They can handle ship-shore traffic relevant to their own operations but this is of little consolation to the private boat owner who is not a member of such a group. He thus faces a double frustration:

Equipment which seems appropriate in terms of cost and size is neither technically adequate nor legal.

Equipment which can perform as required is too costly, often too bulky, and is legal only if operated in conjunction with the OTC/ATC system.

What about emergency equipment? A few years ago, there was talk of self-contained distress beacons which could be activated to provide both an initial distress call and a signal for subsequent radio location but I gather that none of these have been judged in Australia, to be appropriate for use in small, private

boats.

So, while the authorities accept that a person in distress can use any means at their disposal to summon aid, the "at their disposal" bit is a problem indeed.

Seeking some enlightenment on the whole matter, I talked it over with Mr. R. Clark, Supt of the PMG Radio Branch for NSW. Mr Clark agreed completely that the operator of a small boat had real problems, in terms both of communication and safety, and he was as concerned as we were that there seemed to be no easy answer, for the various reasons already set out.

After talking with Mr. Clark, it seemed clear that the best hope for private boat owners would be for the Government to authorise equipment to operate in the International VHF Mobile Band in the vicinity of 156MHz, much as is being done in the United States. Shore stations might conceivably be privately operated in special cases but would more likely be part of a network of remotely controlled transceivers linked back to a central control point by landline.

The attraction of this scheme is that VHF radiotelephone equipment is already manufactured on a large scale for use in land vehicles and is compact and convenient, reliable, not prohibitively expensive, and economical in terms of battery drain in the receive mode. Adaptation for marine use would be relatively simple.

A further advantage is that fully resonant aerials can be used and, assuming suitable on-land receiving sites, range should be reliable and predictable.

In the USA 2-way radio communication for small boats is moving into the VHF Mobile Marine Band, not as a concession, but as a legal requirement. A variety of equipment is coming to light, ranging from the storage battery powered type already mentioned, to hand-held units, the more elaborate equipment being switchable for certain nominated channels. The move will take the pressure off the overworked small-ships frequencies around 2-6MHz, avoid the inadequacies of the CB approach and provide a much more predictable service.

In Australia the PMG's Radio Branch is looking in this direction but I gather that the authority to proceed is held up somewhere along the Government pipeline. In the meantime, small boat owners presumably enjoy their extra hour's fishing over the off-shore reef, hoping all the while that their family won't misinterpret their non-return. Or maybe that the motor will start when they do decide to head home!

Or have we missed something?

How would you advise G.A.W. in his problem, apart from not sailing off-shore at all?

Maybe the smart thing would be for both him and his wife to do a bit of study and get themselves an Amateur Novice Licence!

University

INSULATION TESTERS



HAND WOUND

The generator is fitted with a centrifugal governor and clutch to maintain a constant speed and voltage.

Dimensions 210 x 120 x 150 mm.
Weight only 2.5 kg.

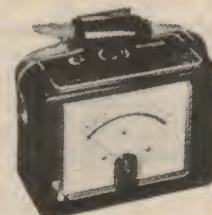


Model	Voltage	Range
UM500	500V	500M
UM1000	1000V	1000M

"UNIMEG"

Transistorised-Solid State in unbreakable rubber case.

9V Battery operated.
Mirror Scale.
Range .25 to 50M



Model TM1 500V

INSULATION AND CONTINUITY

Transistorised-Solid State Compact-Lightweight. (370 g).

Constant voltage circuit.
Pilot Lamp to indicate if switched on.
Resistance Continuity to 100
Supplied with leather case.



Model	Voltage	Insulation	Res.
F602/500	500V	100M	100
F602/1000	1000V	2000M	100

For further details, please contact:

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Pathfinder and visitor alert unit

How easily can a stranger find his way from your front gate to your front door on a dark night? While your path may not be as circuitous as the one which inspired this project, the idea of illuminating it as a visitor approaches has much to recommend it.

by K. F. FORD*

A visitor to our home has to walk up two steps from the footpath to the front gate, go through the gateway, up one more step, turn right and mount seven more steps, turn left and walk along a path for some 25ft, turn left again, and mount a further seven steps to the verandah and front door.

Nothing to it? On a dark night, and particularly for the elderly or infirm, it can be a somewhat hazardous undertaking. Only if visitors are expected would one normally turn on an outside light in anticipation.

Hence the unit to be described. It automatically switches on the outside light and sounds a warning buzzer in the house whenever the gate is opened. The outside light remains on for 40-45 seconds, which is ample time for the slowest person to reach the verandah. The buzzer operates for two to three seconds.

As an "early warning—visitor approaching" signal it is invaluable.

A reed switch is mounted in the gate

post with the operating magnet mounted in the gate. Since the reed is normally open a second (bias) magnet is set into the gate post behind the reed. The magnet in the gate is orientated so as to oppose the field of the bias magnet. Thus the reed is open when the gate is shut and closes when the gate is opened.

Also at the gate is a spherical lamp shade with the house number painted on its interior. It is illuminated by a 12V 6W car globe and is mounted above the gate. This runs continuously and shows up very well at night.

The control unit is located centrally in the house. It is mains operated via a step down transformer delivering approximately 7.5V. A half-wave rectifier and a 1000uF capacitor delivers about 10V DC.

A three-core cable runs to the gate. The black lead is treated as a common and connects to one side of the 7.5V winding at the control unit and to one side of both the reed switch and the globe at the gate. The red lead connects to the other side of the reed and returns

to one side of relay 1 in the control unit. The green lead completes the circuit from the globe to the 7.5V winding.

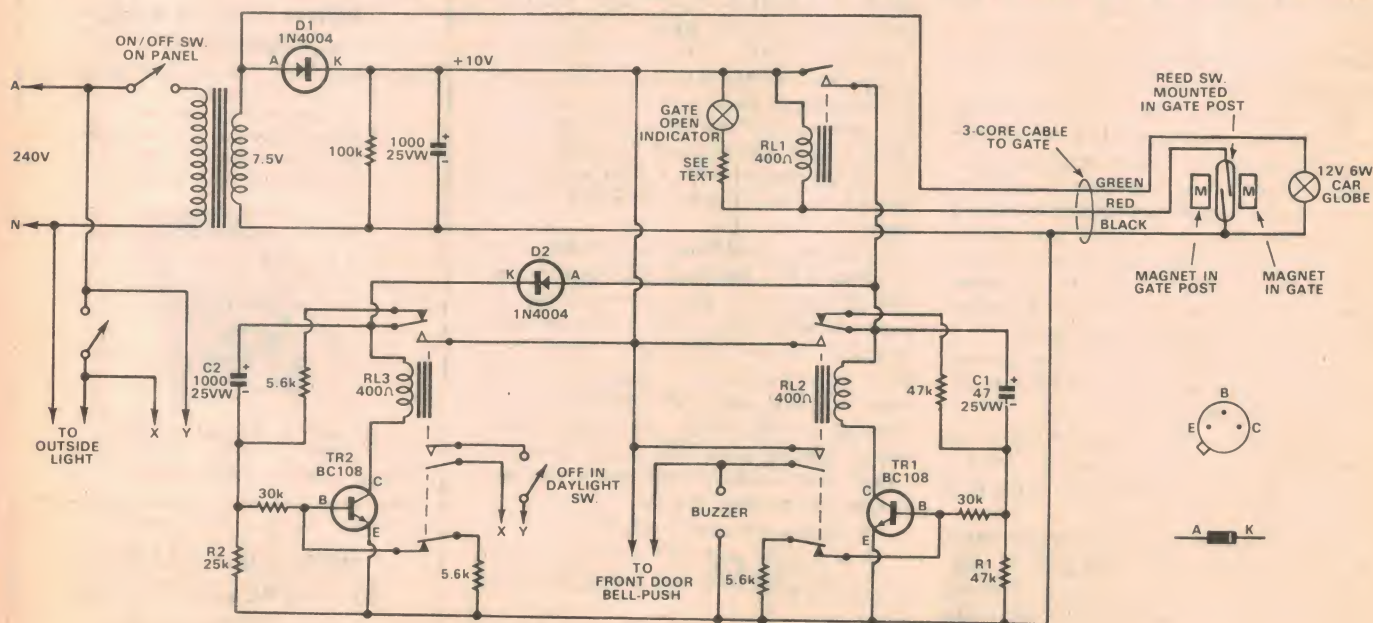
When the gate is opened relay 1 is energised. Its contact connects the +10V positive rail to one side of both relay 2 and relay 3. The other side of each winding goes to the collector of TR1 and TR2 respectively.

Forward bias is applied to the base of TR1 due to the charging current through C1 via R1. TR1 conducts and relay 2 pulls in. When this happens its upper contacts provide a latching function by effectively shunting the relay 1 contacts. Thus relay 2 holds in regardless of the condition of the reed switch or relay 1.

A second set of contacts on relay 2 connects the +10V rail to the buzzer. At the end of a period determined by C1 R1, when C1 has charged sufficiently, forward bias is removed from TR1, relay 2 drops out and switches off the buzzer.

At the same time the normally closed contact opposite the latching contact connects a 47k resistor across C1 (5.6k for C2) to discharge it in anticipation of the next operation. This assumes that, by this time, the gate has been closed and relay 1 has dropped out.

At the same time as relay 2 is energised the +10V line is connected to relay 3 and associated circuitry via diode D2. The functions of this section are essentially similar to those associated with



The circuit is relatively simple and the component values not unduly critical. The unit may be built in any convenient form, but care must be taken in any part of the circuit where mains voltage is involved.

relay 2, except that C2 is larger than C1 (1000uF). The relay 3 contacts marked x and y are connected in parallel with the outside light switch, so that the outside comes on as soon as the gate is opened and remains on for about 45 seconds while C2 is charging.

The diode D2 prevents any possible second operation of the buzzer while relay 3 is still energised.

CAUTION: The wiring from the outside light switch must conform to the appropriate wiring standards, since the 240V mains are involved. Such wiring should be performed only by a qualified electrician.

For the same reason the relay contacts involved must be capable of carrying the current involved and, more importantly, be adequately insulated for 240V operation.

(Editorial Note: A simpler approach might be to use a low voltage lamp for the outside light, operated from a suitable transformer.)

PARTS LIST

- 1 Power transformer, 240V primary, 7.5V 2.5A secondary. (Ferguson PL15/20VA or similar.)
- 3 Relays, double changeover, V23027-B0002-A101 or similar
- 2 Diodes, 1N4004
- 3 Transistors, BC108

CAPACITORS

- 1 47uF, 25V
- 1 1000uF, 25V
- 1 2000uF, 25V

RESISTORS (all 1/2W)

- 3 5.5k
- 1 25k
- 2 30k
- 2 47k
- 1 100k
- 1 reed switch
- 2 magnets
- 2 switches, type 42
- 1 Bezel with 12V globe, type B6/B11
- 1 resistor mounting panel
- 2 Mains terminal strips

In the event that the visitor is slow in closing the gate, or has left it open, voltage will continue to be applied to both transistors after they have been biased off due to C1 or C2 being fully charged. Without some protective arrangement the circuit which discharges the capacitor could also turn on the transistor again, with the risk of relay chatter.

To guard against this another pair of normally closed contacts is used to connect 5.6k resistors between base and emitter of each transistor, thus ensuring insufficient bias to allow either relay to pull in again while either C1 or C2 are discharging. Neither the buzzer nor the outside light will operate again until the gate has been closed for some 5 to 10 seconds.

The control unit is fitted with two switches and an indicator bezel. One switch is in series with one of the outside light leads and, in its off position, is used to inhibit the outside light in daylight. The other switch is used to turn the whole unit off if not required. The globe in the bezel is in parallel with the relay 1 winding and is an indicator that the gate is open. The resistor in series with this globe is chosen to suit the globe and the amount of illumination required.

The switch controlling the outside light could be a double pole type with its second pair of contacts turning off the house number light during the day.

Layout of the unit is not critical. The original unit was housed in a wooden box measuring approximately 12in (H) x 5in (W) x 3 1/2in (D). It is suspended from the picture rail above a convenient power point. The buzzer is mounted on the lower outside end of the case.

The mains lead terminates in the box in a six section mains connector strip which connects it to the on/off switch and the transformer leads. This connector also accommodates the leads from the outside light switch, the x and y contacts of relay 3, and the panel switch controlling the outside light.

On the outside of the case near the top is another section of mains connector strip. The three core lead from the gate terminates here, along with a pair of bell wires running to the bell push on the front door. The latter are wired in parallel with the relay 2 buzzer contacts.

The 3-core lead between the house and gate should be run through 1/2in water pipe or garden hose for protection, particularly if buried. Where the lead emerges at the gate it is terminated in a three section mains connector strip, together with the leads from the car globe and the reed switch. The whole assembly is sealed against the rain and garden sprinkler with a stout plastic bag tied open end down.

The buzzer could be replaced by a bell or set of door chimes, if available. Check the voltage requirements and fit a series resistor if necessary.

The unit as described was built some 12 months ago (at the time of writing) and has been completely reliable since its installation.

PLEASE NOTE

This project is one contributed to our Kits-EA Competition. As such, it has not been through our laboratory and should not be regarded as a regular "Electronics Australia" project. We will therefore not be in a position to answer postal queries about its operation, or supply back-up information, diagrams, etc, beyond what is published. And while we may quote the contributors name and address, to authenticate the article, the contributor is under no obligation to answer letters about his project. That is entirely a matter of his own inclination and convenience.

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(1.75" - 4.45 cm) long and VERY little weight (less than 1 gram). Ideal for difficult IC testing. Connect DIRECT to IC... Reduce resistance build-up. Same high quality construction as our models X-100W, (2.25" - 5.7 cm) and XL-1, (5" - 12.7 cm): Durable heat and chemical resistant nylon body, Gold-plated Beryllium copper contact, Stainless steel spring. Single contact point makes fast, safe, short-free connections... assures accurate readings.

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KITSETS

HOT TIPS

Until recently, if you wanted a first-class hi-fi system, you had two ways to get it. You could buy a kit and build a system from scratch, if you were technically inclined, or you could buy ready made units which were expensive and dull. In fact the only pleasure you'd get would be the matching of your amp, speakers and turntable.

Now, for the first time, KITSETS makes possible a top quality system you build yourself without tears! It's the new MOD-AMP range—a comprehensive array of professional modules, fully wired and tested, designed and manufactured here in Australia.

Choose from MOD-AMP's selection of amps, preamps, tuners, tone controls, mixers and light displays to build the system you want, with the features you need. These are ideal for Hi-Fi, Public Address and Rock Groups.

Simply decide which modules you want, house them, and connect up. No need to buy everything at once either. To update or expand your system, simply purchase modules to suit perhaps a filter, tuner, decoder, light display or quad system. Anyway, check out the rest of the details in the body of the ad., and speaking of bodies, what man hasn't an eye for a pair! . . . (I'm talking about speakers of course) . . . and what better way to add "body" to your Hi-Fi setup, than with the big sound of a pair (or two pair) of 15" big ones. Take it from someone who knows, the difference is unbelievable. In fact that's my tip of the month . . . a sneaky way to make your present system sound twice as good.

And if you're a do-it-yourselfer, you can save almost half by building up our new 15" kits. Incidentally each issue from now on I'll be letting you in on some interesting and exciting new products . . . so look in next month.



- ★ **AM/FM STEREO TUNER MODULE** **\$49.50 P & P \$2.50**
This is one of the highest quality prealigned modules available. Kitsets has looked at cheaper modules, but we found none that would give us the performance required for high quality stereo reception.

SPECIFICATIONS

Range: 88 to 108 MHz. Sensitivity: 3.5 uV. Signal to noise: 52 dB at 100 uV. Stereo separation: 25 dB at 100 Hz. Stereo indication: 100 mA globe. Signal strength: 200 uA meter required. This module includes decoder. AM section has the same specifications as AM module. Power supply is 12 v at 22 mA.

- ★ **AM TUNER MODULE** **\$19.50 P & P \$1.50**
Range: 535 KHz to 1.605 MHz. Aerial: Ferrite rod included. Sensitivity: 80 uV. Signal to noise: 20 dB at 80 uV. Power supply: 9 V at 4 mA. Best value for money.

- ★ **7.5 w STEREO AMP MODULE** **\$19.50 P & P \$1.50**
Power supply: 24 to 32 V. Response: 50 Hz — 100 KHz ± 3 dB. Load: 8 ohms. Input: 100 K ohms. Gain: 39 dB. Distortion: Typically less than 0.1%.

- ★ **15 w MONO AND STEREO AMP MODULE** **\$19.50 P & P \$1.50**
Power supply: ± 16 V to ± 20 V. Response: 10 Hz — 100 Hz ± 3 dB. Load: 8 ohms. Input: 25 K ohm. Gain: 33 dB. Distortion: Typically less than 0.1%.

- ★ **30 w MONO AND STEREO AMP MODULE** **\$29.50 P & P \$2.00**
\$39.50 P & P \$2.50
Power supply: ± 24 V to ± 30 V. Response: 10 Hz — 100 KHz ± 3 dB. Load: 8 ohms. Input: 25 K ohms. Gain: 30 dB. Distortion: Typically less than 0.1%.

- ★ **60 w MONO AMP MODULE** **\$39.50 P & P \$2.50**
Power supply: ± 32 V to ± 40 V. Response: 10 Hz to 50 KHz ± 3 dB. Load: 4 ohms or 8 ohms. Input: 10 K ohms. Gain: 30 dB. Distortion: Typically less than 0.1%.

- ★ **120 w MONO AMP MODULE** **\$49.50 P & P \$3.00**
Power supply: ± 40 V to ± 48 V. Response: 10 Hz to 50 KHz ± 3 dB. Load: 4 ohms or 8 ohms. Input: 10 K ohms. Gain: 30 dB. Distortion: Typically less than 0.1%.

- ★ **PREAMPLIFIER MODULES** **\$12.50 P & P 60c**
Input: 10 K ohms. Output: 100 mV. Distortion: Typically less than 0.05%. Response: 25 Hz to 50 KHz, -1 dB. Power Supply: 18-22 V. Stereo magnetic cartridge: 2.0 mV input. Dual Lo-Imp microphone: 0.2 mV input. Dual Hi-Imp microphone: 2.0 mV input. Dual guitar preamplifier: 30 mV input. Dual tape head preamplifier: 0.2 mV input.
Each module has two channels so that it can be used for stereo, or for dual channels. Lo-impedance microphone preamplifier is suitable for 600 ohms input. Tape head preamplifier is suitable for 9.5 cm/sec., and one capacitor per channel can be altered for other tape speeds.

- ★ **STEREO CONTROL UNIT** **\$25 P & P 60c**
Input: 100 K ohms. Output: 1 K ohm. Gain: 20 dB. Response: 20 Hz — 50 KHz ± 1 dB. Maximum output: 2.5V. Tone control: Bass ± 14 dB at 50Hz. Treble: ± 13 dB at 10kHz. Loudness: Control at -30dB, + 8dB at 50Hz, + 3dB at 10kHz. Distortion: Typically less than 0.05%. Supply: 18-22V.
This module includes the potentiometers mounted on the board, including an optional loudness control. It is a versatile unit which can be used with all the amplifier modules.

- ★ **STEREO MIXER UNIT 8 INPUT** **\$12.50 P & P 60c**
Input: 100mV. Output: 100mV. Response: 25Hz to 100kHz ± 1 dB. Input impedance: 5 K ohms. Distortion: Typically less than 0.05%. Power supply: 18-22 V.
Any of the inputs can be used, just use as many 10 K level potentiometers as required.

- ★ **STEREO MUTE UNIT** **\$12.50 P & P 60c**
Gain reduction: 30 dB, adjustable threshold. Response: Fast attack, slow delay. Power supply: 18-22 V.
This module is for reducing the noise generated by channels which are not being used — adjustable but automatic operation. Ideal when a number of inputs are being used.

- ★ **STEREO VU METER AMP** **\$12.50 P & P 60c**
Drives 200 mA VU meter from control unit output. Power supply: 18-22 V.

- ★ **MONO FILTER UNIT** **\$12.50 P & P 60c**
Power supply: 18-22V. Low frequency turnover: Adjustable 20Hz — 200Hz. High frequency turnover: Adjustable 5 kHz — 50 kHz. Distortion: Typically less than 0.1%. Response: 20Hz — 50kHz ± 3 dB. This module contains adjustable turnover points, with the controls mounted on the boards.

SPEAKER SYSTEMS YOU CAN BUILD OVERNIGHT

Basically assembled boxes, only the finishing touches to be made.

P & P \$5.00 PER BOX.

8" + 1"	ETI 400 \$23.50
12" + 1"	43 litre \$23.50
12" + 5" + 1"	67 litre \$27.00
15" + 5" + 1"	73 litre \$32.00

RADAR INTRUDER ALARM BEAT THE BURGLAR!!!!

This alarm was featured in Electronics Today, May 1975. Using the latest economy radar unit, this alarm detects movement in the area covered by the alarm, up to ten metres. The kit includes the CL8963 device (which is specified for Australian standards), and can save you hundreds of dollars.

\$59.00 P&P \$2.50.

LOW COST, HIGH PERFORMANCE, MAGNETIC CARTRIDGES.

ES-70S \$12.50 P&P \$1.00

Response: 15Hz-25kHz
Output: 5mV
Tracking: 1.0-2.5gm
Stylus: conical diamond

ES-70E \$21.50 P&P \$1.00

Response: 10Hz-30kHz
Output: 4mV
Tracking: 0.7-2.0gm
Stylus: elliptical diamond

Both these cartridges have good tracking ability, low distortion, and wide frequency response.

ELECTRONICS AUSTRALIA'S EDUCATE, SECTION 1.

For all those KITSETS customers who have been waiting patiently—here it is! The first section of the desk top computer. We will be supplying the second section next month. This section includes the case, transformer, two fibreglass boards, switches, front panel, and sockets.

\$239.00 P&P \$5.00

OVAL CAR SPEAKERS 9" x 6"

Plessey Rola C9-6L. These have a power rating of 7 Watt. Both 8 ohm and 15 ohm are available—please state the resistance required. This month reduced from \$7.10 to a ridiculous \$4.95. P&P \$1.00.

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You know Philips, and you know Philips quality. Now we can offer you Philips speakers for the most popular systems. Here's a sampling:

AD1060-T8, 1" Dome tweeter	\$12.50	P&P \$1.00
AD8066-W8, 40W, 8" woofer	\$17.50	P&P \$1.50
AD12100-W8, 40W 12" woofer	\$42.00	P&P \$2.00



Quartz crystal drive for fluorescent readout clock

If you built the Fluorescent Readout LSI Digital Clock featured in our April 1975 issue, here is an interesting accessory: a crystal-controlled 50Hz drive source which uses just one integrated circuit. Build it and adapt your clock for battery operation in cars, boats and caravans.

by LEO SIMPSON

Latest reports on the "Fluorescent Readout LSI Digital Clock" as featured in April, 1975, indicate that over 1500 have now been successfully completed—which must make it the most popular clock yet described. We are sure that many of those readers who have built the clock would be interested in this modification, as would many other readers who have yet to "have a go" at building a clock.

A small PC board measuring just 50 x 38mm accommodates this "simple" circuit, which derives a 50Hz square wave from a crystal operating at 3276.8kHz. The compact PC board is arranged to sit above the original clock board which accommodates the MM5314N clock IC plus its associated circuitry and fluorescent readout tubes.

Heart of the 50Hz clock driver circuit is a "queer looking" five-legged integrated circuit. It is in a TO-5 can and is made by Solid State Scientific with type number SCL5411. It is described as a CMOS oscillator/16-stage divider/buffer by the manufacturers. This means that quite a lot happens inside that little can.

Actually, the SCL5411T contains an oscillator inverter, 16 flip-flops connected in series, and a low impedance buffer output stage. The inverter is wired into a circuit which includes two resis-

tors, two fixed capacitors, one trimmer capacitor and the crystal mentioned above. The crystal frequency when divided by two sixteen times gives a resultant output of 50Hz (ie, 3276.8KHz is the product of 50Hz multiplied by two raised to the power of 16).

The crystal required is a parallel-mode type coded IEE and made by Hy-Q International (Australia) Pty Ltd.

Two versions of the combined clock plus 50Hz driver circuit can be built. The first is mains-powered and has a 15V standby battery to keep the 50Hz driver

and the clock chips operating in the event of a mains interruption. Here the aim is to ensure that no time error occurs. The low voltage readout filaments are of course not energised during mains interruptions.

The second version is powered from a 12V battery and has the virtue of being completely independent of mains supplies. It may be used in cars, caravans and boats. We shall describe operation and construction of the mains-powered version first.

As the first step in building the mains-

At right is a view of the completed mains powered version with the crystal drive unit mounted in position.

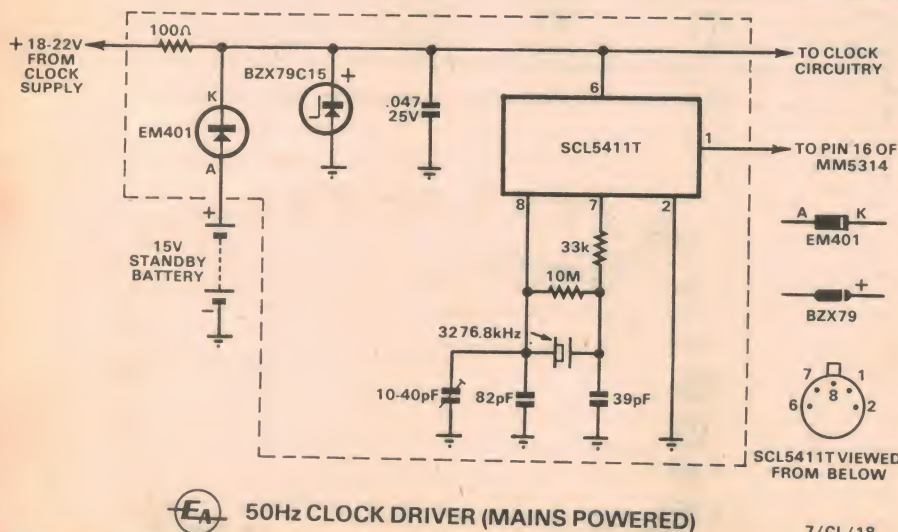
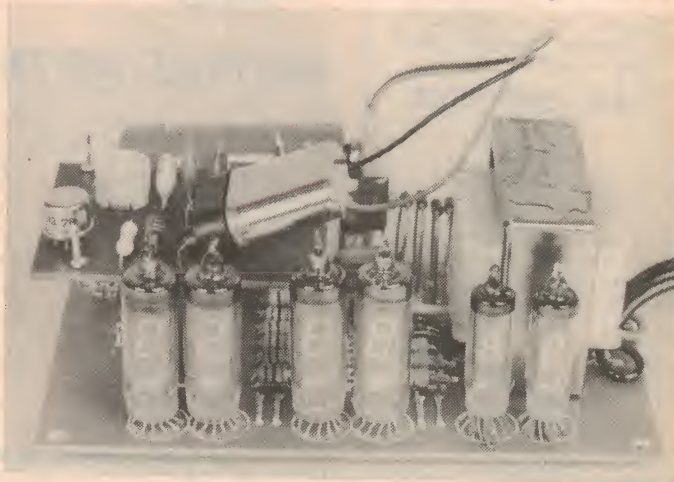


Fig. 1. Note that the 3276.8kHz quartz crystal is a parallel mode type (IEE).

powered version, you should build up the clock PC board exactly as described in the April 1975 issue of "Electronics Australia" (File No 7/CL/17).

When you have the clock operating from the mains, you can then assemble the small PC board for the 50Hz clock driver. The circuit is shown in Fig. 1 with the components on the small PC board enclosed within the dotted border.

A 15V supply rail is derived from the clock DC supply (which is a nominal 18 to 22 volts) by the 100 ohm resistor and 15V zener diode. Electrical hash is removed from the supply by the .047uF/25VW bypass capacitor. This 15V rail is also used to run the clock circuitry on the main PC board. This is necessary because the clock pulses fed to pin 16 of the MM5314 need to have an amplitude almost equal to the chip's supply rail. This is assured by running both IC's from the same 15V supply rail.

Having the facility of crystal-controlled

timekeeping in a mains-powered clock is futile unless there is a standby battery to power both chips in case of a power interruption. Accordingly, an EM401 silicon diode connects a 15V battery when the mains power is removed, and isolates the battery when mains power is available.

The 10 to 40pF trimmer is made by Stetna and suits the board pattern. Incidentally, all the component parts for this driver circuit, including the PC board, IC and 3276.8kHz crystal, are available from Dick Smith Electronics.

Assemble all the components onto the board leaving the SCL5411 until last. This IC is supplied with its leads pushed into a piece of black conductive foam, which protects the device from the build-up of damaging static charges. Leave the IC in the foam while soldering it to the PC board, ie, with the foam sandwiched between the IC and board. Leave the foam there until the board is connected to the rest of the clock circuitry and you are ready to switch on.

PARTS LIST

1 PC board, 50 x 38mm, code 75c19
 1 SCL 5411 integrated circuit
 (Distributed by Cema (Distributors)
 Pty Ltd, 21 Chandos Street, St
 Leonards, NSW 2065)
 1 Stetna 10-40pF trimmer
 1 BZX79/C15 zener diode
 1 EM401 silicon diode
 1 82pF NPO ceramic capacitor
 1 39pF NPO ceramic capacitor
 1 .047/25VW ceramic capacitor
 Half or ¼W resistors:
 1 x 10M, 1 x 33k, 1 x 100 ohm
 1 parallel-mode crystal, 3276.8kHz,
 HY-Q Code IEE
 1 crystal socket to suit

Extra Parts for Battery Version

2 82 ohm 5 watt wirewound resistors
 2 EM401 silicon power diodes or
 equivalent.

Now that when the 50Hz driver board is complete, some modifications to the clock board are required before the two PC boards can be interconnected. First, remove the 100k resistor and 0.01uF capacitor associated with pin 16 of the MM5314. The junction of these two components becomes the feed-point for the output of the 50Hz driver board.

Next, cut the copper pattern so that the positive connection of the 470uF/16VW reservoir capacitor is isolated from the rest of the circuit. Only one cut, close to the capacitor, is necessary. Similarly, make one cut to disconnect the positive output of the bridge rectifier from the circuit. Now connect the positive output of the bridge rectifier to the positive connection of the 470uF capacitor with a short length of hook-up wire soldered to the underside of the board.

The 50Hz driver board can now be connected to the clock board. It is supported on two stout sections of tinned

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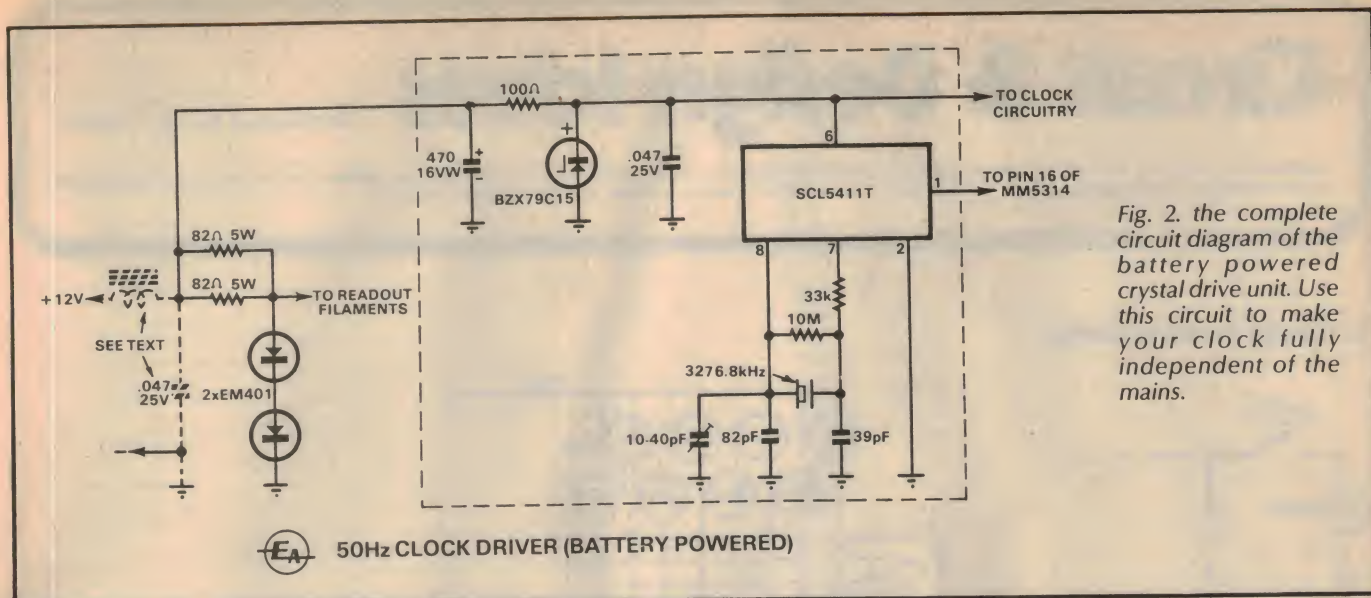
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copper wire (16 SWG). One piece of tinned copper wire connects the 0V rail of the 50Hz driver board to the 0V rail on the clock board, ie, to the copper pad for the HOLD time-setting switch.

The other support wire connects the 15V rail of the 50Hz driver board to the emitter pad of one of the readout transistors. Once the support wires are soldered to the main board take care not to flex them unduly, otherwise they may lift the copper off the laminate. Needless to say, two holes have to be drilled in the main board to accept the support wires.

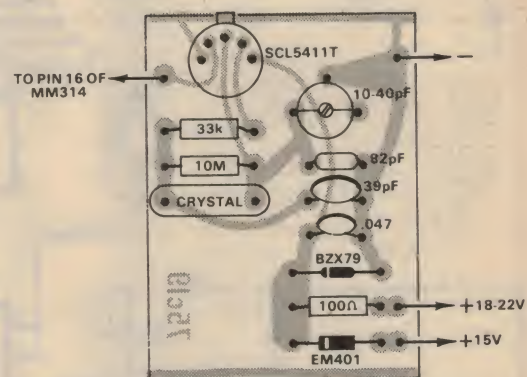
Having installed the support wires, the output of the driver board can be connected as noted previously. Then connect a wire from the positive side of the 470uF filter capacitor to the supply input of the driver board. Finally remove the foam sandwiched under the SCL5411 IC and you are ready to switch on.

The 15V battery we used was an Eveready type 411. It is possible also that you may be able to get the circuit work-

The component layout shows the PC board from the component side. Pattern is shown actual size.

ing with a nine-volt standby battery, which is more easily obtainable. But for reliable operation we would recommend the 15V type, as it will have a longer effective life.

The battery powered version needs a few more modifications on the clock board. First, you can omit the power



transformer, bridge rectifier diodes and the 100k resistor and 0.01uF capacitor associated with pin 16 of the MM5314.

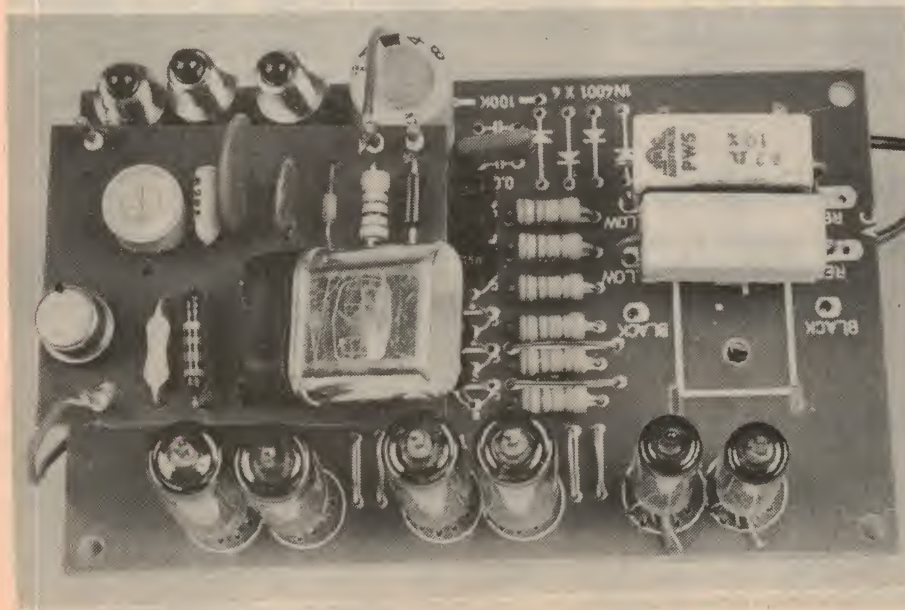
Now install the two 82 ohm/5 watt resistors, in place of the transformer, as shown in the photograph of this version. The resistors are connected in parallel underneath the board.

Connect two diodes in series from the negative of the two 82 ohm resistors to the 0V line, underneath the board. The diodes form a 1.4V regulator or limiter for the filament supply to the fluorescent readout tubes. Now connect the 1.4V supply from the diodes to the filament line—this connection is marked BLACK on the board topside, near the edge.

Run a piece of hook-up wire from the 12V input to the positive side of the 470uF capacitor.

Now you can install the 50Hz driver board above the clock board, as described for the mains-powered version. Incidentally, the battery isolation diode on the driver board may be omitted for this latter version.

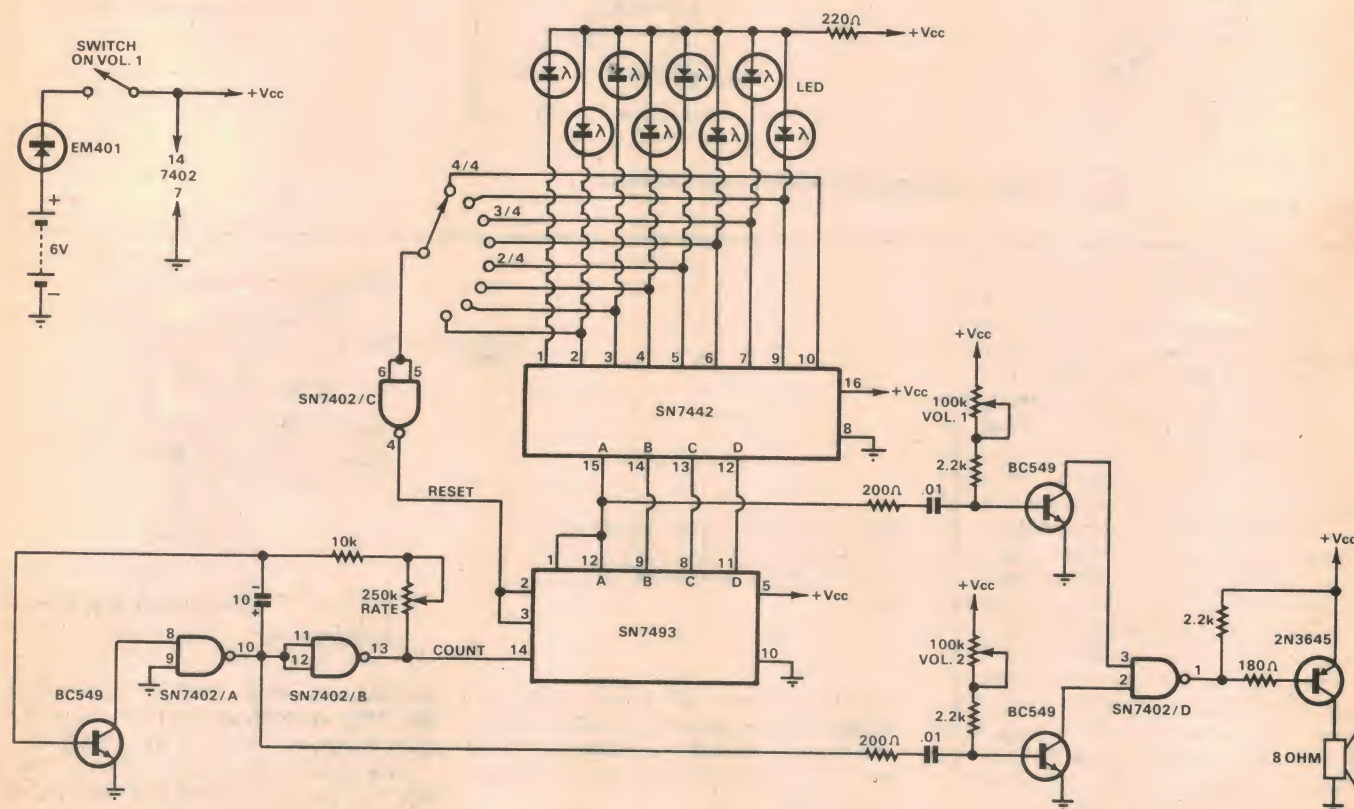
If the battery-powered version is used in a car and appears to be troubled by ignition hash, then the filter components shown dotted in the circuit of Fig. 2 should be included. The inductor is a 0.8H choke, type SH-3, which can be supplied by Paris Radio of 7a Burton Street, Darlinghurst, NSW, 2010.



Above is a general view of the completed battery powered version.

Conducted by Ian Pöqson

A novel metronome



78 ELECTRONICS Australia, September, 1975

tance.

(b) The cross modulator has always better diode operating conditions.

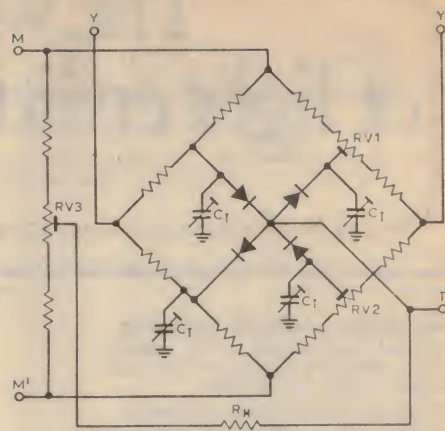
(c) From the point of view of the switching signal the cross modulator can save a substantial amount of power.

He thus suggests that the use of the cross modulator may provide either circuit simplification or parameter improvement.

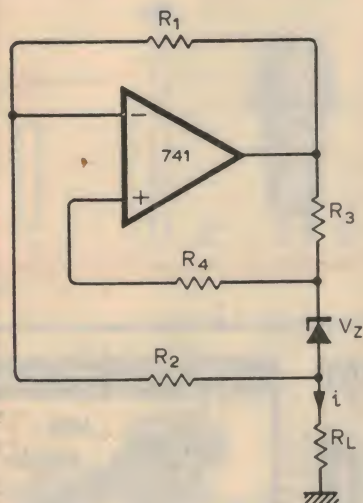
A diagram of the basic transformerless ring and cross modulator is shown, while the diagram indicates how balance is achieved and is based on a

proven arrangement. From the switching signal side, the modulator is balanced by pots RV1 and RV2 (real components) and by capacitances CT (imaginary components), including semiconductor diodes capacitances. From the modulating signal side, the modulator is balanced by pot RV3. At 38kHz (stereo decoder) the achieved suppression of carrier and its harmonic components was 60 to 80dB. The circuit is said to have been tested at frequencies from 10Hz to 1MHz.

(From "Radio Communication".)



Accurate current generator



Most operational amplifier constant-current circuits suffer from the disadvantage that they require a load isolated from ground. The circuit shown uses a grounded load and, using the 741 op-amp, can achieve a Norton equivalent of an ideal current source in parallel with a resistor of greater than 100M when delivering one milliamp of current.

The output impedance of the current source is primarily decided by the common-mode rejection of the amplifier used. As current through R2 is also approximately constant it does not affect the output impedance.

In the diagram

$$i = \frac{R_1}{R_2} \cdot \frac{V_z}{R_3} + \frac{V_z}{R_2}$$

(the second term may be neglected if R2 is large) and

$$R_4 = \frac{R_1 R_2}{R_1 + R_2}$$

Normally $R_L < R_1 = R_2$ and $i = V_z/R_3$ (By R. Morcom, in "Wireless World".)

Simple volume expander

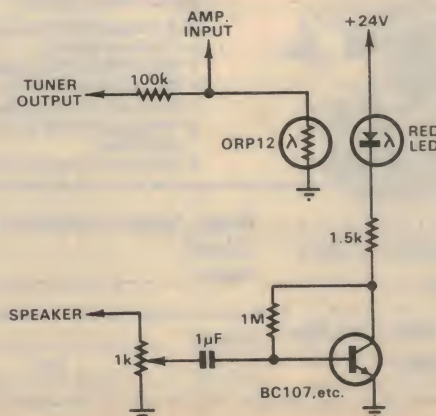
I am interested in high quality broadcast reception but unfortunately all tuner designs for reception of AM transmissions seem to be lacking in one vital aspect—dynamic range. All available transmissions appear to be compressed to a greater or lesser degree.

In an attempt to overcome this problem, I tried a volume expander circuit described in "Popular Electronics" but this did not entirely meet my requirements. The accompanying circuit is the one which I have adapted and permanently wired to the output of my Homodyne tuner. The audio from some of the broadcast stations can be most satisfying.

Signal from a loudspeaker is taken via a 1k potentiometer. The tuner output and amplifier input are connected as shown. The LED and LDR must be enclosed in a light-tight compartment. The 1M resistor should be adjusted where necessary, to give approximately 5mA through the LED with no signal.

(By Mr. A. Kethel, 4/1-3 Cambridge Street, Gladesville, N.S.W. 2111.)

Editorial Note: While it is evident that this circuit gives complete satisfaction to the author, there may be room for experiment whereby an amplifier may be added and operating conditions of the transistor(s) be varied to give optimum results.



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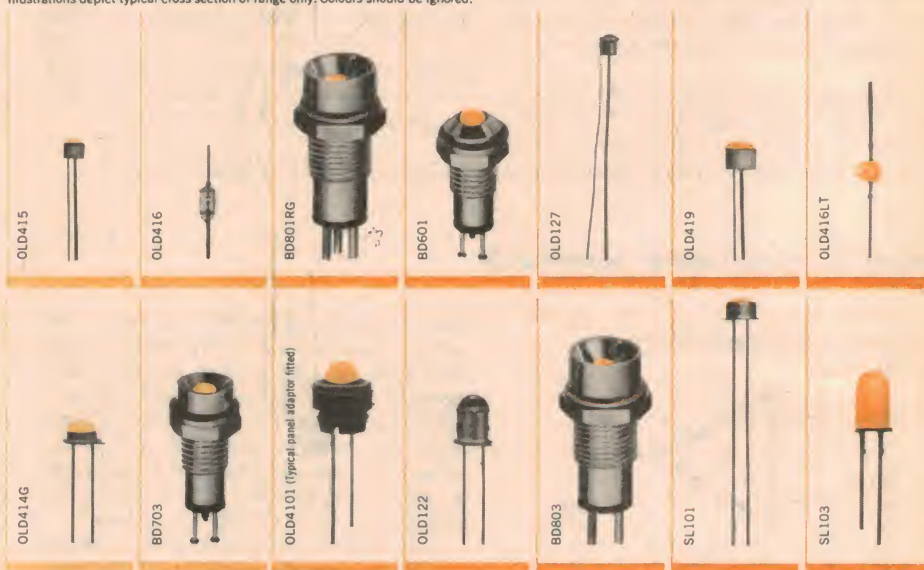
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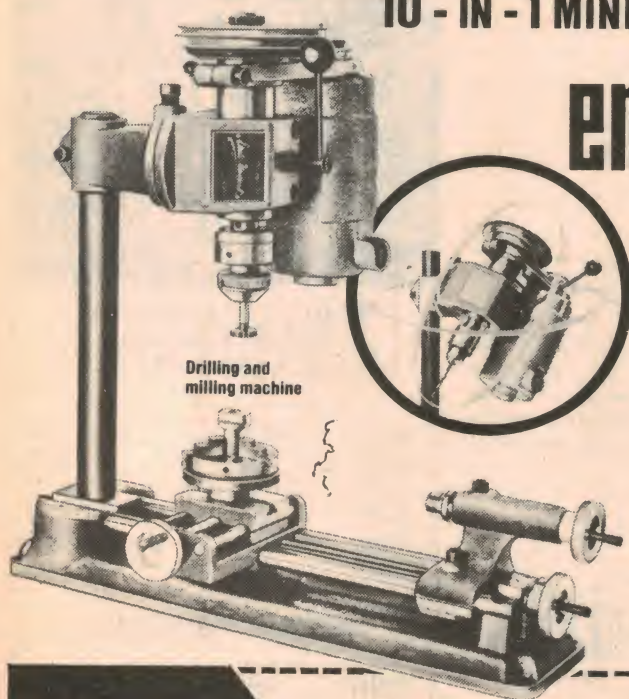


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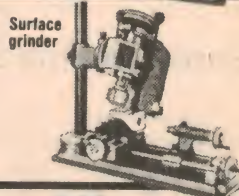
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Letters to the editor

The views expressed by correspondents are their own and are not necessarily endorsed by the editorial staff of "Electronics Australia". The Editor reserves the right to select letters on the basis of their potential interest to readers and to abbreviate their contents where this appears to be appropriate.

EDUC-8 too small

First of all, I would like to congratulate you on your series of articles on mini-computers. I agree entirely with your sentiments. There is plenty of information on individual devices, but none on the interconnection of same.

Now one criticism. On account of economy you have limited the word lengths to 8 bits and the total number of words to 256. This limits the usefulness of the device to the function of a teaching aid, ideal for teaching institutions, but not much use to anyone else.

I am an Accountant, and could justify purchasing a minicomputer if I can use it in my office. To do so it must have a reasonable storesize, preferably at least 1000 words of 16 bits. If the price were 3 or 4 times that mentioned by you, I could still justify this expense. Interfaced with an IO writer (say IBM or Facit) and a mass memory (Tape or preferably disc) it could be used daily in my office for analysing receipts and payments, preparing mailing lists, used as a word processor, etc.

I appreciate that not everyone would spend \$1000 on a minicomputer. As storage is only dependent on the number of devices employed would it not be possible to design the mother board in such a way that the machine can be commissioned in its basic "teaching" mode, as is but with provision to add a further PC board to increase the memory and/or number of registers, as stated above. This would enable everybody to get the machine of his choice.

Trusting that you may be able to give the above some consideration and wishing you all the best,

E. M. Zimmermann,
Wellsford, N.Z.

COMMENT: I considered designing the machine so that it could be readily expanded into a larger and more pretentious version, but it became fairly clear that this would have complicated the basic design very considerably. Our design was meant to fill the vacuum below this level, and it seems to have done so fairly well.

Definition of time

At school another student and myself have posed a question which as yet still hasn't been satisfactorily answered. The question is posed in a spirit of inquiry, not simply to pose a question which can't be answered.

The question is, can you give a lateral definition of time?

If you, your staff or any reader could answer this question, we and the school staff would be grateful.

Chris Jones
Bassendean, W.A.

COMMENT: We presume you are using "lateral" here to mean "imaginative alternative", in which case there would surely be an infinite number of such definitions. Yet in a strict sense, time cannot ever be defined at all, as it is one of the basic parameters of existence. About all one can really do is say something like "Time is the difference between 'now' and '... now!'"

Hot chassis TV

I have recently learned that a number of brands of colour TV sets sold in Australia have chassis which are "hot". I am quite dumbfounded as I thought that in this enlightened age such barbaric practices went out with 90 volt batteries in portable radios. What are the powers that be doing to allow these death traps into the country?

I am sure that after a few servicemen have been fried that this fraternity will swiftly realise the dangers involved and take the necessary steps to ensure that no more of their brothers get zotted.

But what of the handy man fiddler, the bloke who until now has been able to whiz the back off his set, find an unlit valve, replace it and become an electronic genius? Finding no valve to change won't be his only shock.

I believe a campaign should be waged to prevent the import of any more of this kind of set, and that sets already in the country should be modified at the manufacturer's expense.

Brian Robb
Lismore, NSW

COMMENT: As a very large proportion of TV sets made and used in overseas countries are of this type, you must presumably regard all such countries as being more barbaric than Australia. Frankly, we have never heard of either a service technician or a "fiddler" having either being killed or injured by this type of set, either here or overseas.

Solar panels

You completely misunderstand the function of special coatings for solar panels! The correspondent who said "good absorbers are good radiators" was quite correct. The function of special coatings is that of selective transmission—being highly transparent to the wavelengths in which most of the Sun's energy lies, and highly opaque to the long infrared.

What happens is that the temperature of the panel metal rises until the amount of energy entering equals the amount leaving; this is the maximum temperature to which the panel can heat the water. As the panel temperature increases, the wavelength of radiation moves towards the visible spectrum, thus more of it is transmitted the higher the temperature becomes.

Your point about open ended systems does not explain why the new panel is any better than a simple black surface. Not that what you are saying is wrong—it is just irrelevant.

David Brown
Northbridge, 2063.

COMMENT: We fail to see how our answer to the correspondent in the July issue can be considered irrelevant. The aim was not to explain the function of the panel coating, but to deal with the correspondent's suggestion concerning a perpetual motion machine by pointing out that heat is removed from the panel by transference to circulating water, as well as by re-radiation.

Ironical brand name

Greetings from the UK!

I thought you and your readers might be amused to learn the name of a specialist hi-fi turntable manufacturer I came across recently in this country: C. H. RUMBLE. No, I'm not kidding!

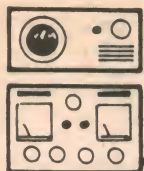
Keep up the good work.
Stephen Frost
Bristol 6, UK

Not amused

I am disappointed in the lack of "local content" in your recent issues of the magazine. It would appear that owing to the present economic climate your superiors are requiring you to cut costs, thus resulting in the present dull splurge of product reviews and reprints from your overseas associates.

J.E.
Como, W.A.

COMMENT: When we publish material from overseas, it is because we believe it will be of interest to readers. The fact is that in the modern electronics industry, most new developments originate overseas. The balance of content in the magazine is determined almost wholly by reader appeal, as reflected by circulation and "feedback". Naturally our management are interested in magazine content, as it affects circulation, but they have never attempted to influence our content in the way you suggest.



The Serviceman

Converting a foreign colour set

Colour TV sets brought in from other countries, usually by migrants, and designed for use in their country of origin can present a sticky problem for any one approached to convert them to local standards. While this can often be uneconomic, the approach by one reader to the problem may interest those who would like to try it on other than a strictly business basis.

The reader is Mr P.T. of Box Hill, Victoria, and he has several interesting comments about colour TV. First, he comments on my story in the April issue concerning a lack of colour in a new set which was only a few miles from the transmitters.

He refers to the "Mazda Book of PAL Servicing" and one explanation it gives for loss of colour. Any condition which causes standing waves on the aerial feeder can create this effect if the reflected signal arrives exactly one half cycle—at the subcarrier frequency—after the original signal (0.11uS approx.).

(This situation was described in more detail in the August issue.)

The only query about this suggestion is the likely cause of the standing waves. As one reader went to some trouble to point out (Forum, March 1975) a mismatch between aerial and feeder will not normally create standing waves, assuming that the receiver is correctly matched to the feeder.

But, as also pointed out in the July issue, amateurish attempts to provide multiple outlet points from a common aerial can easily create this condition.

But Mr P.T.'s main story concerns the conversion problem; conversion of sets from overseas standards to our local standards. Personally, I treat such sets much as I would the plague—I steer well clear of them. And if anyone asks my advice about bringing in such a set I tell them to forget it.

But Mr P.T. was faced with a fait accompli; the set was already here. On this basis he didn't have much to lose by giving it a go. Considering that he did not have even a circuit to work with, he seems to have done a remarkably good job.

Here is his story:

You may be interested in a project I was asked to undertake recently. A "friend of a friend" returned to Australia this year after two years in the United Kingdom. His personal effects followed by ship, including a colour TV set. I was

asked what could be done about making it work here.

I explained what I knew of the difficulties involving different intermediate frequencies, sound video separation and UHF versus VHF channel selectors but agreed to have a look at it to see what could be done. I also advised the owner to try to obtain a copy of the service manual from the British agents.

The set arrived through customs two weeks before C-day. It was an 18-inch Hitachi Model CEP-180. The local agents could offer the owner no assistance so it was brought to me and a request sent to Britain for the service manual.

The first thing, after making sure that it would function, seemed to be to obtain some sort of monochrome picture. I disconnected its own UHF tuner and connected an IF signal from a 'spare' TV set (i.e., the output from its tuner) taking care to keep both leads isolated via suitable capacitors as I suspected that I was working on a hot chassis. Actually, I later discovered that the set did have a mains isolating transformer.

A monochrome picture was easily obtained and the next step was to adjust the sound IF transformer(s) and discriminator (wherever they were) to 5.5MHz instead of 6.0MHz. Following the lead from the volume control lead me to the right part of the relevant board and an inspection of the numbers on the board relative to the various components enabled me to guess which two coils were involved. After noting their original position I turned the cores of each coil in about $\frac{3}{4}$ to 1 turn each, a little at a time, and obtained quite reasonable sound. Although I realised there would probably be some tuneable sound traps elsewhere in the circuit I decided to leave these until the circuit was available.

The next step was to obtain colour but this was complicated by the fact that only a few hours a day were being transmitted, at that time. When a station eventually obliged colour was obtained, but it was sensitive to signal strength,

fine-tuning, etc. (A set top antenna only was being used.)

Tests over the next two days on all channels and with another tuner showed that these two old valve tuners would produce the required 39.5MHz IF with suitable adjustment to the fine-tuning preset controls.

While I would have been prepared to remove a tuner from an old non-repairable set, even to the extent of buying one for this purpose, this was unnecessary as I could obtain an old 10 channel incremental AWA tuner, with valves, from a disposal source for \$4.00. The hardest part was fitting this into a suitable box and making this acceptable, with suitable knobs, etc., to sit on top of the set in the living room. A small 230V power supply had to be fitted in too, together with suitable switching to enable the set's own UHF tuner to function if required in a few years' time.

Apart from physical construction, a major problem was adjusting the preset fine tuning so that colour was received at the centre of the fine-tuning range with a minimum of fiddling on all channels. In this regard a turret tuner would have been easier but it was made more difficult by the fact that there was hardly ever a time when more than one channel was transmitting colour at the same time and I was around to see it.

Eventually, the set was brought into my living room and set up next to our own colour receiver for comparison. The results obtained were quite good except that channel 0 was a bit 'touchy'. When the fine-tuning was set so that colour reception was good the sound was slightly distorted and vice-versa. I decided that this might be improved when the various sound traps were located and adjusted.

Since C-day was approaching, the set was returned to its owner who, on my advice, installed a loft antenna with a 75 ohm co-axial feeder. I understand that the set is still performing satisfactorily, with the previously mentioned trouble on channel 0. Since the time it was installed the service manual has arrived and, when I manage a free Saturday morning, I will attempt to adjust the sound traps. (The fault appears to be sound information entering the chrominance channel.)

Well, that's Mr P.T.'s story and, as I said at the beginning, I think he did a particularly good job, considering what he had to work with. Others faced with the same problem should have learned a point or two.

Finally, Mr P.T. describes a fault which developed in his own colour set, and which he feels reflects adversely on the manufacturer. He says: Another matter which may interest you relates to a fault which I located in my own colour receiver (AWA Model 603.) This is an AWA-Thorn 4KA chassis.

After being in use for some weeks I noticed that the picture was subject to

"blooming" on bright scenes and/or when the brightness control was advanced. In the worst cases "motor-boating" of the brightness occurred. The EHT SET control was ineffective and up at the "high" end of its range.

Voltage and resistance checks showed that the voltage at the junction of R352 and C339 was high. A 68k resistor, not shown on the circuit, was strung on the "wrong" side of the board between this point and earth. When removed and tested R352 was found to be about 650k instead of 1M. This is a special purpose resistor which has about 1000V across it and consequently dissipates about one watt.

A direct replacement could not be obtained from the makers and so it was replaced by four 1M one watt resistors in series/parallel and the 68k resistor removed. The EHT SET control could then be adjusted satisfactorily, at the other end of its range.

The point of this story is that it appears that a fault was discovered at some time during production testing and "cured" by adding the resistor to earth. In use, the faulty 1M resistor became lower in value and, eventually, had to be located and replaced. This is hardly a good manufacturing practice and I hope that there are not too many other examples of it around, both for the sake of users and servicemen. Come to think of it, I hope that there are not any other examples of it in my set.

Thank you for your many informative stories. The "Serviceman" pages are the ones I usually read first in each issue of Electronics Australia.

Well thank you, P. T., for your interesting stories and the kind remarks about the magazine. Regarding the AWA receiver we agree that, at first glance, it appears to have been a "bodgie" approach. On the other hand, I suspect a more subtle series of events which led to this situation, and which was outside the control of the manufacturer.

First, it is not unusual for manufacturers to "pad" certain components, in critical circuits, by mounting an additional component on the opposite side of the board. This may be necessary in only a small percentage of cases and the component padded may not necessarily be the one which is out of tolerance. This can still be a perfectly legitimate approach where the nature of the circuit allows one tolerance to be balanced against another and where, for reasons of cost, it is more logical to add a low cost component, rather than change—and possibly reject—a higher cost or more awkwardly placed one.

In this case I suspect that the 1M resistor was marginally low when it was fitted, and that the possibility of this was allowed for in production testing by fitting a 68k (or other suitable value) resistor.

Subsequently, the 1M resistor dropped a lot further in value; something which could not necessarily have been foreseen during testing. If any criticism is justified it might concern the wisdom of choosing the particular type of resistor for this role, but this is something which a manufacturer often learns the hard way; from his sets in the field.

In the meantime other readers may learn from your experience; where this model set exhibits similar symptoms it would be worthwhile checking this resistor before launching into an extensive test routine.

And to finish off, here is a brief story from a reader which is worth keeping in mind.

"This family owns a portable receiver which is knocked around and frequently dropped. Inevitably, it suffered a broken ceramic aerial rod.

"The rod was replaced but, even with fresh batteries, the sound was weak and distorted.

"The speaker was removed and several pieces of the aerial rod, and other stray pieces of magnetic material, were found clinging to it."

A.B., North Mackay, Q.

Thank you A.B. and while I have not experienced this situation myself, it is easy to understand how it could happen.

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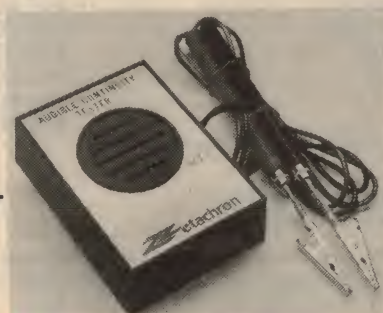
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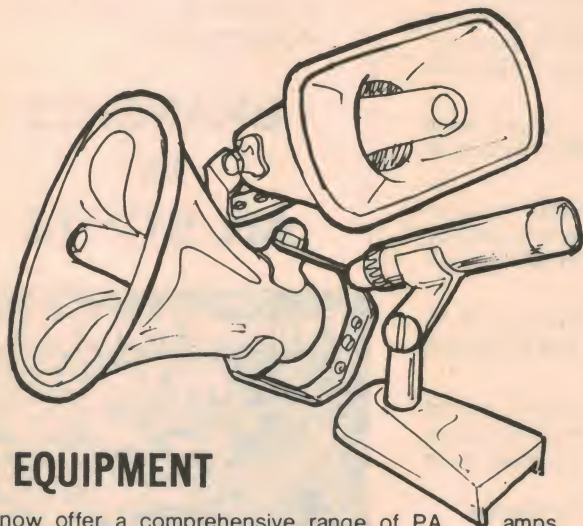
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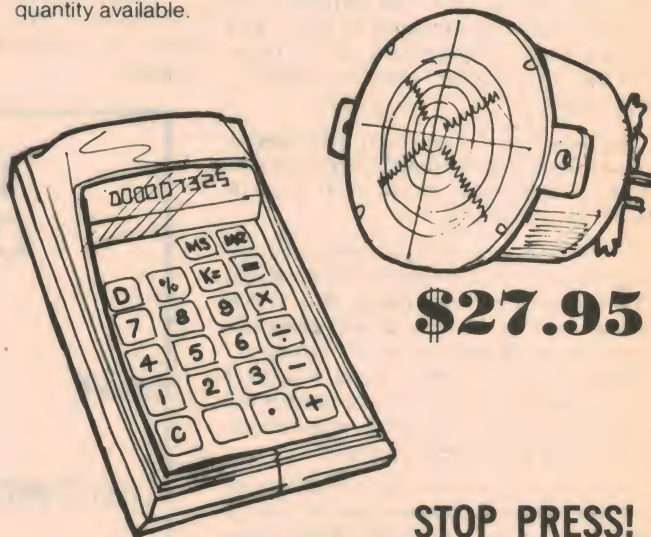
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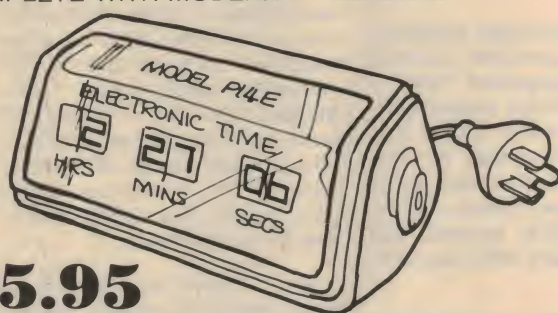
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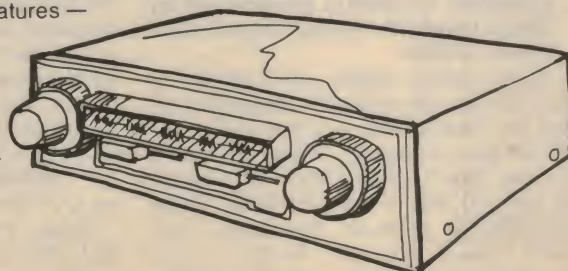
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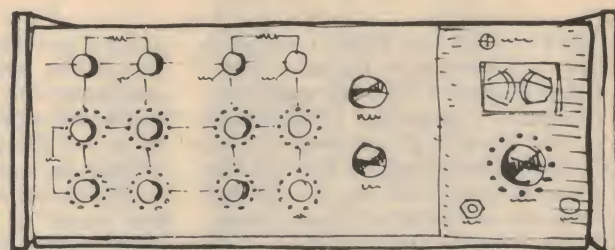
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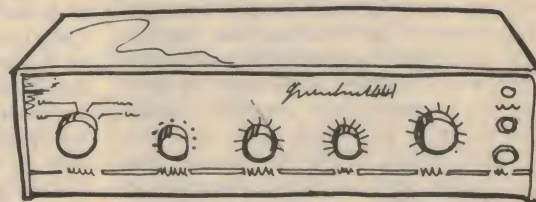
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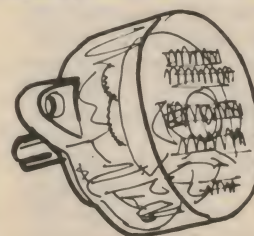
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Classical Recordings

Reviewed by Julian Russell



Mozart: *Così fan tutti*—complete opera

MOZART—Così fan tutti. Complete Opera. Montserrat Caballe (Fiordiligi); Janet Baker (Dorabella); Wladimiro Ganzarolli (Guglielmo); Nicolai Gedda (Ferrando); Ileana Cotrubas (Despina) and Richard Van Allen (Alfonso) with the Chorus and Orchestra of the Royal Opera House, Covent Garden conducted by Colin Davis. Philips Stereo 6707 025. (Four discs).

Colin Davis doesn't take long to make it clear that, unlike many musicians, to him *Così fan tutti* is not a frivolous opera. True, it has its light moments and its beginning is consistently in this light vein. Here Davis is possibly at his best in his excellent account of the opera. His tempos are lively, his orchestra clear and splendidly balanced and everywhere the accents are carefully observed and beautifully executed. There is no surprise that his grasp of Mozart's quicksilver emotional changes are handled with unerring perception. Consider the contrast, never caricatured, between the soulful, parodied parting of the two sisters, and their swains' self-confident smugness at its outcome. These are the sorts of situations that Mozart expresses so subtly—his orchestral comment is in itself a delight—and Davis never misses a point.

But I am not so sure about Davis' treatment of the first act finale. Mozart's finales are notoriously difficult to bring off perfectly, so finely does he combine his characters' differences of personality within his general scheme. On the whole, at first hearing, everything seems to go splendidly. The changes of tempos and moods are charming to the ear. It is only on closer study that an occasional passage seems just to fall short of perfection. But then how many "absolutely perfect" presentations of a Mozart opera are without minor blemishes? I know of none in any recording I have ever heard, and my listening goes all the way back to the Glyndebourne sets of Fritz Busch. I have however, always regarded Beecham's witty but altogether ill-natured sneer. "Good Mozart needs no Busch" as unworthy of that great operatic conductor.

The general atmosphere of Act 1 grows much more emotionally complex

in Act 2. Just how are the many ambiguities of the plot recognisable without uncharacteristic exaggerations? Perfection in this aspect would be miraculous, whoever the performers might be, despite the composer's surest of sure touches in the music. And without them the "moral" of the opera suffers—under Davis' baton very slightly indeed. But they are there if you follow the score with sufficient attention.

Up till now I have been writing about the beautiful orchestral playing and Davis' interpretation of the composer's intentions. But when we come to the singing things are sometimes less satisfactory. Outstanding in my opinion is Ileana Cotrubas' Despina. Here is Mozart singing of the very highest standard. Every note is given its exact emphasis—or lack of it. She has the talent always to find the cusp of a phrase with unerring instinct—or it may be study. Dorabella is one of Janet Baker's favourite roles. Her weighty but always smooth voice of the most alluring quality ranges effortlessly from passion to frivolity and Montserrat Caballe (Fiordiligi) partners her to perfection. Her voice, too, never fails to charm whatever the situation on the stage. Technically an occasional failure to hit the true pitch of the many widely separated intervals can be expected and excused. Yet here it just never happens. Every note is struck dead centre without the slightest

loss of quality. And she can push a phrase out effortlessly yet never aggressively in the most complex writing of the ensembles. If her interpretation of the role leaves something very slight to be desired, ample compensations can be found in the beauty of her singing.

Nicolai Gedda at times sounds a little tired, with some of his customary lyricism occasionally missing. But his is a generous, manly Ferrando despite rare moments of tonal roughness. I am afraid I cannot say the same about Wladimiro Ganzarolli's Guglielmo. Compared to the others his style is altogether too coarse for a good Mozart performance. He is sometimes off pitch and his characterisation is no better than his singing. Such roughness is quite alien to this always extremely subtle opera. I liked better Richard Van Allen's Alfonso. The Italian buffo tradition can probably be blamed when he descends into overstressing some of the humorous aspects of his part, but on the whole his is a good tuneful performance.

The diction is consistently excellent, a point that gives unusual pleasure to the sprightly recitatives. But here again I cannot approve the continuo which, for some reason or other, confines itself too often to the higher register of the instrument. There is also too much apparent enjoyment of his own over-ornamentation. The use of the appoggiatura is often a question for debate in music of this period. If overdone it can sound niggling. If cut out altogether, as sometimes happens here, it brings a phrase to too abrupt a transition between notes.

The engineering is clear and never fogs the lucidity of Mozart's wonderful scoring. The balance within the orchestra and between the players and singers is always sensitively preserved. If this set has its very minor faults I don't know of another which hasn't any. If I recommend this one enthusiastically it is simply because I am at a loss to recommend one better. It should satisfy all but the hypercritical.

Walton—The Bear: "good comic opera"

WALTON—The Bear. Complete one act Opera. Monica Sinclair (Popova); John Shaw (Smirnov); and Norman Lumsden (Luka) with the English Chamber Orchestra conducted by James Lockhart. World Record Club Stereo S/4525.

Good comic operas, and by this I mean those with wit in the orchestral part and no buffoonery on the stage—are indeed rare nowadays. Those that come to mind most readily are Verdi's immortal Falstaff, and on a somewhat lower level Ravel's *L'Heure Espagnole*, Puccini's *Gianni Schicchi*, Wolf-Ferrari's *Susannah's Secret*, and Scheck's *Fisherman and his Wife*. I can't recall either of

the last two being presented, at any rate professionally, in Australia. But Walton's delightful little work can easily take its place among all but the Falstaffian work. There is humour in some of the situations (adapted from a short story by Chekov) in the libretto all wittily commented on in the orchestral score. In the latter, most of the fun comes from a series of parodies of other composers' styles sneaked into the entertainment with all the deftness that Walton displayed so early in life in his *Facade* music.

Some of these parodies are immediately obvious, others more elusive, and some might perhaps be missed altogether even by the best informed lis-

teners. I must leave it to you to pick those you can identify and guess at those you can't. You will get no help, by the way, from the bare libretto provided with the single disc. It is important to point out that this wholly delightful exercise goes on without in any way disturbing the even running of the stage action. The orchestra is small, but it is surprising how rich Walton can make his limited number of musicians sound whenever he wants to. But the players are the English Chamber Orchestra so that I need add no more in the way of praise of that part of the entertainment.

The diction of the singers is generally so good that after having acquainted oneself with the story, the libretto can easily be put aside even the first time through. The vocal line is admirably singable, seeming to follow the almost conversational style used by Ravel in his *L'Heure Espagnole*. This, allied to the magnificent quality of the engineering, makes understanding of what is going on quite easy. It also has a tendency to magnify the always large presence—both physically and vocally—of baritone John Shaw, though this is never taken beyond the bounds of valid characterisation of The Bear—a local landowner in financial difficulties—somewhat along the lines of Baron Ochs in *The Rosenkavalier*. Shaw has achieved considerable refinement since he first sang in opera in Australia many years ago. Then his Scarpia in *Tosca* used to remind one of a member of the Darlinghurst Vice Squad rather than an aristocratic Italian police chief. But he still has a habit of seeming just a little larger than life size, though as I said above this is no very great fault here. Monica Sinclair is perfect vocally and dramatically as a tough minded widow. As her old manservant, Norman Lumsden uses his fine bass with splendid discretion.

This little opera—it runs only about 50 minutes—is a real charmer. Walton uses a verismo style in a completely contemporary manner but, thank heavens, without any reliance on 12-tone abuses. The rhymes have quite a Gilbertian quality. Presented in the right spirit it should be a winner in the Opera Hall of the Sydney Opera House complex.

It would make an excellent double bill teamed with one of the other witty one-acters I noticed earlier. With Walton's tightness of expression, its small cast and orchestra and the composer's well controlled exuberance it never drags. I strongly recommend it for all its very great merits which will not only provide you with much enjoyable listening but will also set you the fascinating exercise of trying to identify the styles of the various composers parodied with such skill.

For information on World Record Club albums, contact the Club at 605 Camberwell Rd, Hartwell, Vic 3124. Tel. 29 2636.

TCHAIKOVSKY—Symphony No. 1 in G Minor. "Winter Dreams."

LIADOV—Kikimora and Polonaise in C. USSR Symphony Orchestra conducted by Yevgeny Svetlanov. World Record Club Stereo S/5029.

It is hard to imagine why this alluring symphony should be so neglected in the concert hall, especially since the composer is coming back into favour among the highest of highbrow audiences, and even accepted in some 12-tone coteries. For many years since the war Tchaikovsky has been consistently written down by snob audiences. Toscanini was alleged, incorrectly, to have said that he would never conduct a Tchaikovsky symphony.

A curious incident happened a few years ago on which this might have some bearing. The American magazine, the *New Yorker*, published a review by its highly regarded music critic that a performance of Tchaikovsky's Fifth Symphony, a recording of which he was reviewing, was not as good as the live performance he had heard Toscanini give in New York some years earlier. Challenged with the fact that Toscanini had in fact never conducted the work in New York, the critic replied neatly that this might well have been so, but that Toscanini would have played it better if he had played it!

The symphony is delightfully

melodious, though in form it does not comply with the highest symphonic tradition. This, however, does not prevent its always pleasant sound from consistently charming the ear. Moreover, on this disc, one is immediately convinced of the authority of the reading of it given by this fine Russian orchestra. They play it with sparkling energy and fervour, with the slow movement, one of Tchaikovsky's great cantilenas, flowing up to a superb climax. The sound is very good indeed, the balance excellent especially when the low basses add a pizzicato accompaniment. If a charge of vulgarity can be sustained against the big horn tune—well that currently much admired composer, Gustav Mahler, is often guilty of the same fault. In any case there is no trace of vulgarity in the graceful, delicate boned Scherzo with its subtle syncopations in its main part and a delicious waltz in the middle section.

The Finale is perhaps a bit on the brash side but, after all, this is an early work and the band plays it for all it's worth. There are two fills, *Kikimora*, and a Polonaise both by Liadov. This composer was first brought to the notice of Western musicians by the famous Russian Ballet entrepreneur Diaghileff who used *Kikimora* for one of its productions about 60 years ago. It is not great music but fine fun and is beautifully played. The Polonaise is just another polonaise.

PHILIPS CASSETTE

ELGAR—Enigma Variations. London Philharmonic Orchestra.

STRAUSS—Don Juan. Symphonic Poem. Concertgebouw Orchestra of Amsterdam, both orchestras conducted by Bernard Haitink. Philips Dolby Stereo Cassette No. 7300 344. Philips Stereo disc No. 6500 622.

This unusual coupling goes far to contradict those who claim that Elgar cannot be played satisfactorily by non-British conductors. Hollander Bernard Haitink interprets both these works impressively and shows no lack of understanding of the Elgar. By the way, this might be as good a place as any to recall that Richard Strauss was a great admirer of Elgar and did much to get his work performed in Germany and Austria. Haitink's is a big reading of the *Enigma*, yet his orchestra loses no lustre for that reason. Moreover Haitink's account is perfectly proportioned. There is plenty of élan in the fast movements and no lack of warmth in the lyrical ones. Elgar, Strauss and Sibelius were perhaps the finest users of the brass section of the orchestra among all the composers for large symphony orchestras. Haitink shows full appreciations of this in both the Strauss and the Elgar.

I could fill this column with praise of the many details to be admired and enjoyed in both these pieces. But, at a minimum, I must mention the stately yet warm playing of the theme in the Elgar, the rumbustiousness of the Troyte varia-

tion, the pianissimo opening of *Nimrod*, the grace of *Dorabella* with its muslin delicacy and nostalgic quotation of Mendelssohn. I could go on and on.

The sound generally is very good on cassette—the coupling is also issued on disc which I haven't heard—and any slight intrusion by the tims can be overcome by a slight cut in the bass control.

Haitink uses his Amsterdam Concertgebouw Orchestra for *Don Juan*. There is a splendid solidity about the vigorous opening that suggests in a way I have never heard before mature impetuosity. Here is a Francis Drake rather than an elegant young Spaniard. Although this might sound fanciful I am sure Haitink had in mind no young rascal but a fully fledged adventurer and I think the work gains from it. And this same characterisation extends even to the lyrical sections which refer to the Don. The women's sections are all intensely feminine. The cassette sound—and I must again mention that I have not heard the disc though I have no reason to doubt its similarity—is all one could desire. And among the many fine first desk musicians you will hear some delicious oboe playing that treats you to a finely etched line of elegant proportions. The solo violin must also be mentioned though I find it strange that his name is featured on the label but not that of the oboist. The whole work is full of seemingly inexhaustible energy. Both orchestras sound at their noble best in these works.



Devotional Records.....

SINGIN' A NEW SONG. Cliff Barrows Presents The Young Church Singers. Stereo, Word WST-8572-LP (From Sacred Productions Aust, 181 Clarence Street, Sydney and other capitals).

For the most part recent compositions, the titles on this album will not be familiar to many, but don't let that deter you—they are very tuneful, well arranged and beautifully presented:

Jesus Walk Past Me; Here Comes Jesus—Until That Time—Make Us One Father God; Loves You And Me—Bring Back The Springtime—Will You Stay Where You Are; Fill Me, Jesus—My Tribute—A Mighty River; Goin' To Build My Life—A Common Love—To A Mountain—Softly And Tenderly; Someone Is Waiting.

While the singers maintain a steady flow of words and melody, mainly from centre channel, the instruments from either side produce a sound that will tickle the ears of any hifi fan—sparkling transients and a heavy throbbing bass.

In sharp contrast to the style of Rudy Atwood's "Wonderful Old Chestnuts", reviewed elsewhere, this one is right up to date and an excellent potential addition to a family collection of devotional albums. (W.N.W.)

★ ★ ★

SOMETHING BEAUTIFUL. The Rick Powell Singers, arranged and Conducted by Rick Powell. Stereo, Singcord ZLP-911S. From S. John Bacon Publishing Co, 12-13 Windsor Avenue, Waverley 3149).

All the songs on this album were written by American Gospel songwriter Bill Gaither, probably best known for his composition "He Touched Me". The number is featured on this album, along with: Let's Just Praise The Lord—My Faith Still Holds—All God's Children—Because He Lives—Get All Excited—Something Beautiful—I Don't Know What You Came To Do—Come Holy Spirit—There's Something About A Mountain—Even So, Lord Jesus, Come.

With varied and generous instrumental backing, the Rick Powell Singers produce a very smooth, pleasant sound that should be eminently suitable for family

listening. The fact that the songs may not be well known should not be a discouragement; they are tuneful and the themes are readily apparent.

The critical listener may catch a few wisps of pressing texture noise on side 1 but otherwise the quality and total balance are well up to standard. (W.N.W.)

★ ★ ★

THE BEST OF JIM REEVES' SACRED SONGS. Stereo, RCA Victor APL1-0793.

"The best of" title is sometimes dubious but, in this case, listeners with a liking for devotional songs will almost certainly go along with it. Though apparently assembled from a variety of sources, the whole program is very smooth, gently rhythmic and with only sparse touches of C&W style. The songs are all well known in church circles:

Take My Hand Precious Lord—Teach Me How To Pray—Whispering Hope—We Thank Thee—May The Good Lord Bless And Keep You—This World Is Not My Home—It Is No Secret—I'd Rather

Have Jesus—In The Garden—He Will.

The recording itself is as smooth as the program. If you like traditional devotional songs, sung in the traditional way, you'll enjoy this one. (W.N.W.)

★ ★ ★

WONDERFUL OLD CHESTNUTS. Rudy Atwood, Piano with String Orchestra Stereo, Word WST-8591-LP. (From Sacred Productions Aust, 181 Clarence Street, Sydney and other capitals).

Faced with this completely honest title, it is almost automatic for a member of the older generations to slip back through the years, to the golden days of radio, when the Old Fashioned Revival Hour won so many listeners with its smooth, polished renditions of favourite hymns. At the piano, Rudy Atwood set a new style for Gospel pianists with his gentle embellishments of the old tunes.

By today's standards of involved improvisation, his familiar embellishments are as much "old chestnuts" as the hymns themselves. But they do have the advantage that the melody is always recognisable, even dominant!

The "chestnuts": Beyond The Sunset—All That Thrills My Soul—Great Is Thy Faithfulness—He The Pearly Gates Will Open—Dwelling In Beulah Land—Some Golden Daybreak—Face To Face—His Eye Is On The Sparrow—Our Great Saviour—How Great Thou Art—Amazed—If I Gained The World.

Combine those tunes with Rudy Atwood's piano, add a small string orchestra and you have an album that will carry your grey hairs back through the years in a restful nostalgic journey! A fully imported album, the quality is excellent. (W.N.W.)

Instrumental, Vocal and Humour.....

SPECTACULAR MARCHES. The Philadelphia Orchestra conducted by Eugene Ormandy. Stereo, RCA Red Seal ARL1-0450.

Branded "newly recorded", this would be a good album for anyone who is on the lookout for a big orchestral sound, but devoted to music that is at the one time appropriate and familiar.

The Philadelphia Orchestra, under its equally well known conductor Eugene Ormandy presents a generous program of marches from their classical repertoire: March Of The Toreadors (Bizet); Festmarsch (Wagner); Marche Militaire (Schubert); Procession Of The Sardar (Ippolitov-Ivanov); Coronation March (Meyerbeer); Wedding March (Mendelssohn); Bridal Procession (Rimsky-Korsakoff); March, Love Of Three Oranges (Prokofiev); Turkish March (Beethoven); Grand March (Verdi);

Radetzky March (J. Strauss).

As per the title, the marches sound "spectacular" on good loudspeakers but they also sound particularly impressive on good stereo phones. Many will enjoy the album in its own right but I can see it being adopted as a demonstration recording for big, symphonic sound, to groups which might show a mixed reaction to heavier—or lighter—fare. Well worth a hearing. (W.N.W.)

★ ★ ★

SNOWFLAKES ARE DANCING. The Newest Sound of Debussy. Performances by Tomita on Moog Synthesiser. Stereo, RCA Red Seal ARL1-0488.

If "Switched-on Bach" caught the imagination with its scintillating Moog sound, this performance of Debussy's beautiful tone paintings may well do the same for an entirely different reason—gentle, ethereal sound that caresses the ear with its quaint merging of Debussy

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.) and David Edwards (D.W.E.).

with electronically generated tones, arranged and performed by an oriental artist.

To be sure, there are the characteristic Moog phrases and stanzas that are more suggestive of a suspense drama or a TV theme than classical Debussy, but Tomita is revealed as a very notable exponent of the electronic music he has specialised in for several years.

The tracks: Snowflakes Are Dancing—Reverie—Gardens In The Rain—Clair de Lune—Arabesque No 1—The Engulfed Cathedral—Passepeid—The Girl With The Flaxen Hair—Golliwog's Cakewalk—Footprints In The Snow.

Gentle, classically derived sound, with touches of the orient, electronic gimmickry and musical giggles, it is interesting to the casual listener and worthy of closer study by the student or specialist. (W.N.W.)

★ ★ ★

THE ALAN HAVEN ORGAN SHOW. Quadraphonic, Astor QUAD 1028.

If the jacket quotes are to be believed, Alan Haven is "the greatest". Without seeking to debate the point, he certainly has a generous share of digital dexterity. The organ itself is also a "Haven", to his own design, apparently with an emphasis on percussive facilities, with piano and harpsichord voices for good measure.

It's actually a 3-man show with Alan Haven on organ and two percussionists. What each contributes would be hard to pick, so well is the sound integrated. You will listen in vain for a traditional organ solo, but you will hear skilful one and two-note melodies against a rhythm accompaniment, convincing piano, and a few effects that are quite Moog like.

The tracks: Close To You—The Odd Couple—Here's That Rainy Day—Finding Words—Watch What Happens—Caravan—Aranjuez Mon Amour—South To The Sun—Scheherazade—Raindrops Keep Falling—Misty—Mozart's Rondo Alla Turca.

The quality is very clean but, played in 4-channel, one has to get used to sounds from one organ coming from opposite ends of the room. The point is, of course, that they can do so in real life from a multi-channel instrument. Fine, as a record of combo style organ. (W.N.W.)

★ ★ ★

THE COLE PORTER STORY. Franck Pourcel and his Orchestra. EMI Studio 2 Stereo TWOX 1028.

Mix Cole Porter's evergreen hits and the orchestral skills of Franck Pourcel and you are bound to come up with a winner. The record has a very forward sounding rhythm, something like the sound on the Spanish 'Hispanovox' discs.

The twelve tracks are: C'est Magnifique—I Love Paris—I've Got You Under My Skin—In The Still Of The Night—Easy To Love—True Love—Begin The Beguine—Night And Day—Just One Of Those Things—Ca C'est L'amour—So In

THE CINEMA ORGAN —historic recording

AT THE CINEMA ORGAN. The BBC Presents. Mono, BBC Records REC-137M. (Available from Phonogram).

Here's an album that deserves a place in the collection of every cinema organ enthusiast. Perhaps this is not a surprising remark because the Cinema Organ Society of Great Britain appears to have had a large hand in its compilation. The jacket notes, in appropriately nostalgic style, are by Tony Moss of the COS.

Drawn from the BBC's own recordings and some early commercial releases, the album is a round-up of many of the big-name British organists who featured on the BBC's regular program "The Organist Entertains". The instruments involved include Christies, an array of Comptons, Wurltizers large and small and a 22-rank Conacher.

Without attempting to list their contributions, which vary from schmaltzy treatments, through gay arrangements and to the formal, the artists read like a who's who: Sandy Macpherson, Al Bollington, Quentin Maclean, Jack Helyer, Reginald Porter-Brown, G. T. Pattman, Sidney Torch, Harold Ramsay, Reginald Foort, Sydney Gustard, Reginald New, Terence Casey, Stuart Barrie, Leslie James, Frank Newman, Edward O'Henry, Lloyd Thomas.

How good were these artists of the golden era of the cinema? Really good or a memory embellished by the passing years? You don't have to listen too long to get your answer. They really knew how to win precision and phrasing from those acoustic giants—something that can't always be said from a later generation of players who probably spend most of their time on electronics, with their entirely different response.

An historic and nostalgic "must", despite the "mono" tag and recordings which pre-date the era of master tapes. (W.N.W.)

★ ★ ★

I'M MOVIN' ON. Hank Snow. RCA Camden ACL1-0540. Stereo.

If you like Hank Snow's style, then you'll probably like this album. Be warned, however; it is a reissue, though at a budget price. Titles included are I'm Movin' On—Green, Green Grass Of Home—There's A Star Spangled Banner Waving Somewhere—With This Ring I Thee Wed—Let Me Go Love—My Rough and Rowdy Ways—Frankie And Johnny—Folsom Prison—I'm Movin' In.

Personally, I find his nasal tones unpleasant. Record quality is good. (D.W.E.)

BACK TO THE COUNTRY. Loretta Lynn. Astor MAPS 7818.

Loretta appears to be jumping on the Women's Lib bandwagon, judging from the featured song on this album, titled "The Pill". Other tracks included are Will You Be There—It's Time To Pay The Fiddler—Paper Roses—You Love Everybody But You—Mad Mrs. Jesse Brown—Back To The Country—The Hands of Yesterday—I Can Help—Another You—Jimmy On My Mind.

While there are one or two exceptions, most of the songs on this album could be classified as sad love songs. I found that the Conway Twitty composition "Jimmy On My Mind" was the one I liked best. On this track, Loretta's voice did not seem quite as strident as on some of the other tracks. Recording quality is excellent. (D.W.E.)

★ ★ ★

ALL-TIME ORCHESTRAL HITS. Geoff Love and his Concert Orchestra. EMI Studio 2 Stereo TWOX.1029

If you are looking for a delightful record for quiet relaxing or for a dinner background, have a listen to this disc. For your money you get these titles; Theme from 'La Ronde'—Love Is Blue—Intermezzo—Blue Tango—Stranger On The Shore—Canadian Sunset—Holiday For Strings—Ebb Tide—Forgotten Dreams—A Man And A Woman—Romance—Lime—The quality and stereo impression are first class. (N.J.M.)

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LIGHTER SIDE

GREATEST HITS OF THE 30s Vol 2.

Arthur Fiedler and The Boston Pops
RCA ARLI-0506.

This is another in RCA's series of all-time hits through the years, making enjoyable listening especially for the Wrinklies like me who can remember back that far! The twelve tracks are: In The Mood—Love Is Here To Stay—Yours Is My Heart Alone—Tumbling Tumbleweeds—Easy To Love—Blue Moon—All The Things You Are—Bidin' My Time—Wagon Wheels—Sunrise Serenade—Someday I'll Find You—Whistle While You Work. With the exception of 'In The Mood' which sounds as if it had been recorded in a barn, the sound quality is superb. Peter Nero is the piano soloist on two tracks, Love Is Here To Stay and Bidin' My Time. (N.J.M.)

★ ★ ★

TOMMY TYCHO'S A NIGHT WITH COLE PORTER. Live at the Sydney Opera House Festival L45597/8 Stereo.

At the special two record price of \$7.95, this album is an excellent showcase of local talent at their best.

Among those performing are Mary Jane Boyd, Peter Brandon, the Claire Poole Singers, Neville Marshall and David Gray.

The titles are too numerous to list here but most of Porter's best known music is represented in instrumental or vocal form. The quality leaves nothing to be desired. In short a very enjoyable album. (N.J.M.)

★ ★ ★

THE BEAUTIFUL MUSIC OF ROGERS AND HAMMERSTEIN. Played on the Sydney Town Hall Organ by Eric Smith. Stereo, M7 label. ML-001.

The title of this recording will be certain to attract the attention of Sydney organ enthusiasts in particular even if it simultaneously produces some apprehension.

Perhaps I had better come right out and say that any such apprehension would not be misplaced on this occasion.

In its own way, the Town Hall organ is a magnificent instrument and I have heard sound from it beguiling and befiting. But, on this occasion, it is simply bewildering.

I am prepared to accept that, in the actual auditorium, it might have made better sonic sense but, via the recording, the melodic flow barely manages to be heard through the reverberated residue of what has gone before.

Blame the organist, if you like, for over-registration, the hall for too much echo, or the recording engineer for less than optimum mic. placement, but the end result is not a happy one.

"Happy Talk"—definitely not! "The Sound Of Music"—hardly! "Whistle A Happy Tune"—couldn't hear myself! "Some Enchanted Evening"—'fraid not! Sorry Eric. (W.N.W.)

★ ★ ★

PUFFING BILLY IN STEREO. Steam Action Productions 33-1/3 EP, stereo SAP 101-S.

No doubt every steam train enthusiast in Australia knows of the "Puffing Billy" narrow gauge line, and those who have visited Melbourne have probably had many rides up through the beautiful countryside from Belgrave to Emerald. The line is justifiably famous, both because of its unique story of a group of amateurs rebuilding a closed-down line, and because of its happy blend of nostalgia and scenic beauty.

Peter Nielson has made this recording of the hard-working little 2-6-2 Prairie tank locos on the 2ft 6in gauge Puffing Billy line as the latest addition to his series capturing the remaining steam train survivors. In a cover note received with the review disc he comments that the recording was produced not only as an historical item for steam enthusiasts, but also as a souvenir for tourists. As one who visited the line a couple of years back—and thoroughly enjoyed myself—I have no doubt it will be successful in both respects.

If you've taken a home movie of the line, it would also be ideal to provide the sound accompaniment. No prizes for

guessing what mine will be used for!

There are four tracks on the EP, each capturing one of the salient aspects of the line, and explained by the sleeve notes. The recording is of good quality, too.

As with previous Peter Nielson recordings, it is distributed by Steam Action Productions, P.O. Box 75, Ormond, Victoria 3204. No price was given, however. (J.R.)

★ ★ ★

FRANCES YIP. With The Nick Ingman Orchestra. EMI EMC-3058 Stereo.

This young lady from the Orient has a voice that belies her diminutive appearance, a voice that should ensure a sound future in the singing game. She makes a splendid job of twelve tracks: Stage Struck — Yesterday When I Was Young — Someday — To Be The One You Love — The Ballad Of The Sad Young Men — Go — Send In The Clowns — One More Ride On The Merry-Go-Round — The Way We Were — He Did With Me — She — For You.

The quality is superb, with an excellent orchestral backing. If you are looking for a new voice for your ballad collection, rush out and buy this one. (N.J.M.)

★ ★ ★

MANIFIESTO. Victor Jara, Chile September, 1973. Transatlantic Records Stereo. L-35415.

Victor Jara was a Chilean folksinger who was murdered during the coup against President Allende on 11th of September, 1973. This record is a representative collection of his work, from 1968 up to his death.

Although all the songs are in Spanish, a sheet of translations and backgrounds is provided. In addition, some tracks are preceded by spoken translations. The songs included are: Te Recuerdo Amanda — Canto Libre — Aqui Me Quedo — Angelita Huenuman — Ni Chicha Ni Limona — La Plegaria A Un Labrador — Cuando Voy Al Trabajo — El Derecho De Vivir En Paz — Vientos Del Pueblo — Manifiesto — La Partrida — Chile Stadium.

The last track is a poem which Victor wrote while imprisoned in the boxing stadium at the Technical University at

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(D.W.E.)

This reissue by Skeeter Davis features, along with the title track, such tunes as: Hello Darlin' – (Today) I Started Loving

My phrase "various artists and orchestras" is in no sense an overstatement. Just reading down a few of the tracks, one encounters Teresa Brown, Andrews Sisters, Frankie Laine, The Weavers, Ames Brothers, Eddie Fisher, Hugo Winterhalter, Manfred Mann, Henry Mancini, The Four Aces, Georgia Gibbs, Tony Martin, Paul Mauriat, Irish Rovers, and so on. And, if that first list omitted names like Bill Haley, Perry Como, Louis Armstrong, Billy Vaughn and Horst Jankowski, it's only because there's a limit to what one can include in a neces-

Personally, I found the album quite enjoyable, though not up to the standard of the Donna Fargo "All About A Feeling" album recently reviewed. Technically, the remastered production is very good, so maybe we should merely conclude that the new generation of country style singers is an improvement on the old. (D.W.E.)

If you were not a fan of the Goons, you may not understand what the fuss was about but they were brilliant in a time before television robbed people of their imagination. These days, comedy programs require elaborate props to be successful. To me, the paradox of the Goons is that they seem quite sane compared to some of today's "entertainers" who really are goons and are not in the least bit funny. (L.D.S.)

Recorded in Dynagroove by RCA, the pressings are completely clean and right up to modern recording standards. And, if you want to play them through a 4-channel decoder, they work just fine. In short, a serving of pleasant, popular music that will keep your ears busy for quite a while! Recommended. (W.N.W.)

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Books & Literature

Using op amps

110 OPERATIONAL AMPLIFIER PROJECTS, by R. M. Marston. Published by Newnes-Butterworth, London, 1975. Soft covers, 213mm x 140mm, 123pp, numerous circuit diagrams. Recommended price in Australia, \$4.50.

This book should have considerable appeal to the enthusiast who has not yet given serious attention to the operational amplifier. In fact, to anyone not yet familiar with this device, this book would seem to be as good a place as any to make its acquaintance.

The approach is essentially practical. The first chapter, Basic Principles and Applications, describes the operational amplifier in terms of what it does. There is no attempt to look inside the device, it is treated simply as a "black box" having certain electrical characteristics as seen looking into its various terminals. This chapter—and indeed the whole book—confines itself to the types 709 and 741; types which are readily available world wide.

The following chapters are devoted to practical circuits designed around these two devices. All the circuits are relatively simple and use only a few ancillary components, all of them quite commonplace, readily available devices, of a non-critical nature.

At the same time the circuits are representative of a wide range of completely practical applications for operational amplifiers, either as self-contained devices, or as part of larger circuits.

Whether you need to solve a particular problem, or just want to learn about operational amplifiers, this book will give you a good start—and a lot of fun into the bargain.

Our copy from Butterworths, 586 Pacific Highway, Chatswood, NSW, 2067. (P.G.W.)

Lightning, etc

INSULATION COORDINATION IN HIGH VOLTAGE ELECTRIC POWER SYSTEMS. By W. Diesendorf Dr. Tech. Sc. Published by Butterworths, London. Hard covers, 220 x 140 mm, 128 pp, illustrated by diagrams and graphs. Price in Australia \$11.00.

The author of this text, Senior Lecturer

at the School of Electrical Engineering, University of Sydney, was formerly system design engineer for the Snowy Mountains Hydro-Electric Authority, Australia. The present book, he explains, is virtually a re-write and an up-dating of material assembled over the years for lectures and symposia.

Chapter headings cover the following subjects: Overvoltage; Disruptive Discharge and Withstand Voltages; Lightning Overvoltages on Transmission Lines; The Lighting Performance of Transmission Lines; The Switching Surge Design of Transmission lines; The Insulation Coordination of High Voltage Stations; Bibliography; Appendices.

It would be inappropriate for an electronics-orientated writer to comment in detail on this specialised subject but readers interested in this field may like to know about the existence of the new book. (W. N. W.)

For the student

BASIC ELECTRICITY FOR ELECTRONICS, by Richard Blitzer. Published by John Wiley & Sons Inc, New York, 1974. Hard covers, 240mm x 190mm, 727pp, numerous line drawings and photographs. Recommended Australian price, \$17.20.

This is a comprehensive text book intended for the serious electronics student. The author is from the RCA Institute; a highly respected teaching organisation in the US. According to the foreword, it is intended for "... the first and second semester courses for electronics technicians."

The author writes with an easy style which is in pleasant contrast to the "dry" approach adopted by some writers. This does a lot to lessen the mystery of an unknown subject. He states in his foreword that "each chapter begins with a simplified approach and proceeds to a more thorough discussion." This is readily evident. In fact, the opening paragraphs of some chapters suggest a most elementary approach; perhaps too elementary for a book of this type. Any such critics should hold their fire until they have progressed to the end of the chapter, where they will find themselves at a very different level. On the other hand, there should be no excuse for a student being discouraged because he is forced to start at too high a level; the starting level should suit anyone.

In summary then, a very good book for the serious student, particularly one who likes things explained in a little more detail than is available in some textbooks. A good reference book for a technical library also. (P.G.W.)

But not this one

BEGINNER'S GUIDE TO ELECTRONICS, third edition, by T. L. Squires and C. M. Deason. Published by Newnes-Butterworths, London. Hard covers 193 x 128mm 240pp, many diagrams. Price in Australia \$5.00.

At first glance this appeals as a useful and commendable book, intended to provide the uninitiated reader with a background in the broad field of electronics.

It begins at the conventional place with electrons, conductors and insulators, moving on to alternating and direct current. Then follow chapters on components, circuit concepts, test instruments, computers, radar, medical electronics, space electronics, television, industrial applications, the future, and training to be an electronics engineer.

Fair enough, as far as the broad intention is concerned, but scanning the text turns up phrases which suggest that the text would have benefited from an examination by experts in the various subjects.

For example (p16) the pars on matching are suspect, leading to a statement

that the load presented to an audio amplifier must match its output impedance; in practice this situation is studiously avoided! On page 26 there is an inference that the radio spectrum starts with frequencies in which the cycle time is "less than one thousandth of a second". On page 30 is the statement that, in any electrical circuit, voltage is the cause and current is the effect. Pentode valves are credited with "many interesting characteristics" on page 67, one being its "ability to produce a constant current whatever the voltage on its grids (within limits)". On page 201 the reasons for an odd number of scanning lines in a TV picture is given as "the half-line being used as an indication to the receiver synchronisation circuits that one field has been completed".

If a quick sampling can turn up pars like these, it doesn't augur well for a detailed study of the text. Sorry, but we can't recommend this one. (W. N. W.)

Communications

ADVANCED COMMUNICATION SYSTEMS. Five separate authors, edited by B. J. Halliwell. Published by Newnes-Butterworths, London. Hard covers, 240 x 160mm, 276 pp, illustrated by photographs and diagrams. Price in Australia \$20.00.

One of a series of monographs being produced in collaboration with STC

(Standard Telephones & Cables Ltd), this book is intended primarily to assist postgraduate students and younger engineers to a better understanding of the vastly involved communications network on which the world now substantially depends.

Each of the authors is a recognised expert in the subject on which he writes. If their contributions overlap or reflect somewhat different value judgments, this is seen by the editor as a factor which is likely to enhance the value of the text to a serious student. The scope of the book is best indicated by listing the chapters, along with their respective authors. Their multiple qualifications are omitted purely for the sake of brevity:

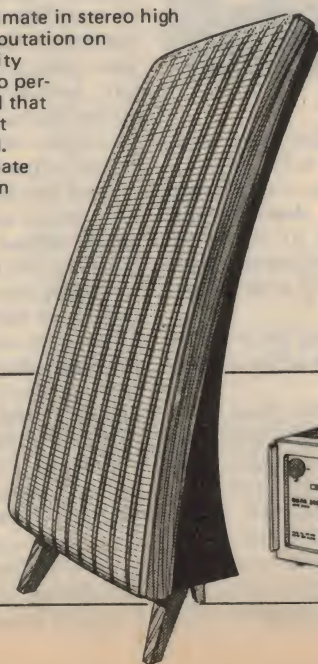
History and Growth (K. G. Hodgson & G. C. Hartley); FDM Systems (K. G. Hodgson); PCM and Digital Networks (G. C. Hartley); Microwave Radio Systems (H. B. Wood); Communication Satellite Systems (O. G. Williams); Optical Communication (C. Kao).

The book appears to be well written and is an authoritative treatment of a subject which, considered as a whole, is nothing less than bewildering in scope and scale. It should be a valuable reference source for the postgraduate student while, at the same time being quite readable by anyone interested in concepts rather than detail.

Our copy came from the publishers who advise that stocks are currently available in Australia. (W. N. W.)

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Below, left to right: QUAD electrostatic loudspeaker, QUAD 303 power amplifier, QUAD 33 control unit, QUAD FM3 stereo tuner.

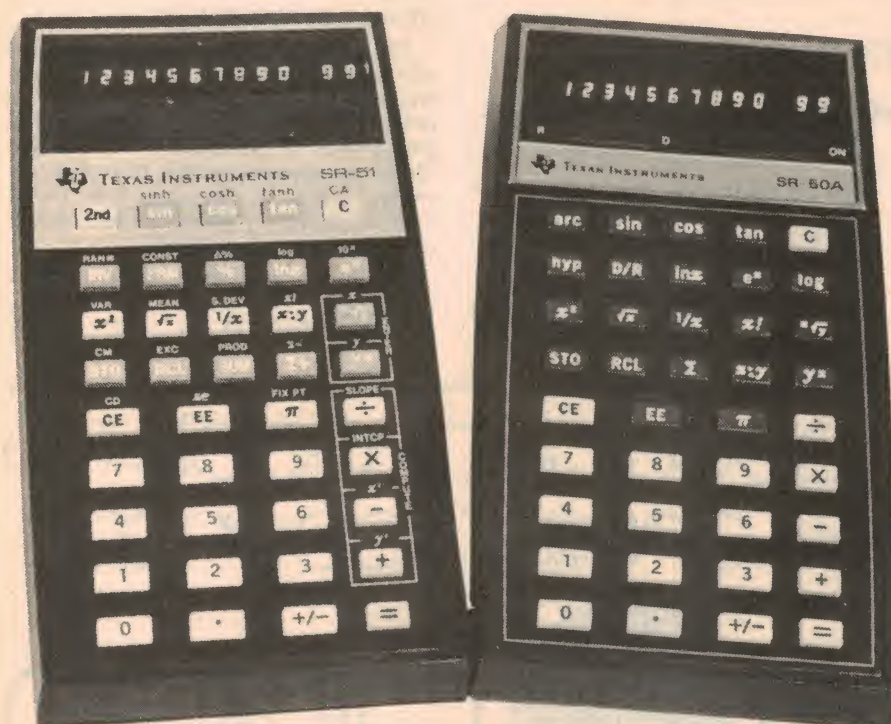
Free literature is available on request from your local QUAD retailer or from the Australian Agent (address above right).



New Products

Two scientific calculators from Texas Instruments Inc

Scientific calculators continue to become cheaper and ever more powerful. Here we review two of the latest from Texas Instruments, the SR50A and SR-51, which feature scientific notation with a 10 digit mantissa and an exponent up to plus and minus 99.



Each calculator is supplied in an attractive cardboard carton together with a "plug-pack" power supply for recharging the batteries. Also a soft zippered vinyl carrying case, which has a loop for attaching to the proud owner's belt.

The SR-51 comes with two manuals: one is the owner's manual which has detailed instructions for all the possible calculations. The other is a brief operating guide for quick reference purposes. The SR-50A comes with a single comprehensive owner's manual.

The push-buttons are small but well-spaced and give a good tactile sensation, ie, they give a positive click when pressed. Readout is via a multi-digit LED display in red.

A big feature of the two calculators is that they both employ scientific notation.

They will compute and display numbers as large as $\pm 9.99999999 \times 10$ raised to the power 99 or as small as 1.000000000×10 to the power -99. Answers are automatically converted to scientific notation when the calculated result exceeds 10 to the power 10 or less than 10 to the power -10.

In addition, variables may be entered directly into the calculator in the scientific notation.

On the SR-50A there are three data registers for data calculation and one memory register for data storage. The memory may be used to store a constant for iterative calculation or to store a calculated result for additional subsequent calculations. A feature is the sum and store key which algebraically sums any displayed number with that in the

memory and then stores the result in the memory.

On the SR-51 there are three data registers and three memory registers for data storage.

Frankly, we cannot even begin to describe all the possible calculations which both units are capable of—they are supplied with comprehensive manuals for that reason. Both units can do such calculations as factorials, reciprocals, roots, powers, trigonometric and hyperbolic functions with just a few keystrokes.

Most calculations take place in less than a tenth of a second although factorials of large numbers do give them some pause. The largest factorial which can be performed is 69! which takes about 2½ seconds to perform before the dramatic result is displayed: 1.711224524 x 10 to the power 98. That is a mind-boggling number to say the least.

What sets the SR-51 apart from the SR-50A are its second function keys. For example, the "ln x" key is also used for log (to the base 10) calculations. Second functions are engaged by pushing the "2nd" key (logical enough).

One particular feature which caused a lot of amusement in our office was the random number generator, which will generate a random sequence of numbers from 0 to 99. Several members of the staff ran bets on the highest number.

Texas Instruments probably have not visualised the SR-51 being used in a betting shop. On a more serious note, the random number facility would be very useful for people performing problems in statistics or probability.

But definitely the biggest feature of the SR-51 is its direct conversion of quantities such as miles to kilometres, yards to metres, Fahrenheit to Celsius and so on. These are exact conversions, not approximations. A particularly convenient conversion is voltage ratio to decibels.

In all, there are nineteen direct conversions possible just by punching in a two-digit code. Combined with the reciprocal key just about every conversion ever needed is available. About the only conversion not directly applicable to the Australian scene is gallons to litres, because it refers to US gallons. But that is easily overcome.

Both the SR-50A and SR-51 have direct conversion available for degrees to and from radians, via a slide switch which matches the on-off slider.

Clearly, we can only present just a brief review of these powerful calculators. It takes quite some time to appreciate their full capabilities. They are almost a mandatory aid to today's engineering students, and design engineers without one are just not in the race.

Recommended retail prices are \$173 plus 15% sales tax for the SR-51 and \$109 plus 15% sales tax for the SR-50A. Retailer enquiries should be made to the Australian distributors for Texas Instruments calculators, A. J. Ferguson Pty Ltd, 44 Prospect Rd, Prospect, SA 5082. (L.D.S.)

Low cost sound level meter

Those needing to make general-purpose noise and sound level measurements should find this low cost meter of interest.

With so much current discussion on the need for, and the possibility of, legislation to curb noise pollution, interest is growing in the standards which will be set down by any such legislation. Similarly, there is considerable interest in the means by which the individual can make meaningful measurements, where it is suspected that such limits are being exceeded.

While highly precise and very expensive instruments might be needed to provide evidence at a legal level, there are currently available modest priced instruments which would be quite suitable for preliminary surveys and as a basis on which cooperating parties might reach an agreement.

One such is the model SM-7 Sound Level Meter made by the Onsoku Electronic Corporation of Japan, and marketed by Dick Smith Pty Ltd. It is an extremely light and compact instrument, measuring only 106 x 66 x 36mm and weighing only 150grams, including the

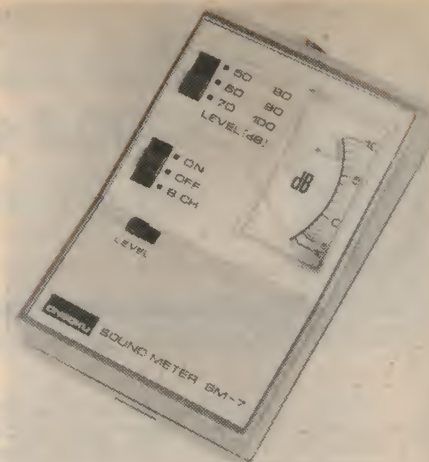
internal 9V battery.

The instrument is calibrated to read from 40 to 110dB, with a meter scale covering a range of 20dB and six ranges having 10dB steps. The meter scale also carries a battery check zone, used in conjunction with an appropriate switch position.

The instrument employs a weighting network according to the international "A" response, the most universally used "weighting" at the present time.

It is fitted with an electret capacitor microphone, and has a frequency response from 31.5Hz to 8kHz. The meter is a ribbon suspension type with a fast damping factor. There is also provision to plug in an earphone (supplied) which, on the lowest range, provides a high order of amplification. This is intended as an aid to identifying individual sounds as likely offenders.

As a matter of interest, a quick check produced the following readings:



Typical office, 50-60dB
Suburban train, 80-90dB
Suburban dwelling, 40dB

(The level in the last named environment was below the minimum level of the meter most of the time.)

The sound level meter comes complete with battery, earphone, and instruction sheet, packed in a moulded plastic foam container. The price is \$47.50. Further information from Dick Smith Pty Ltd. (P.G.W.).

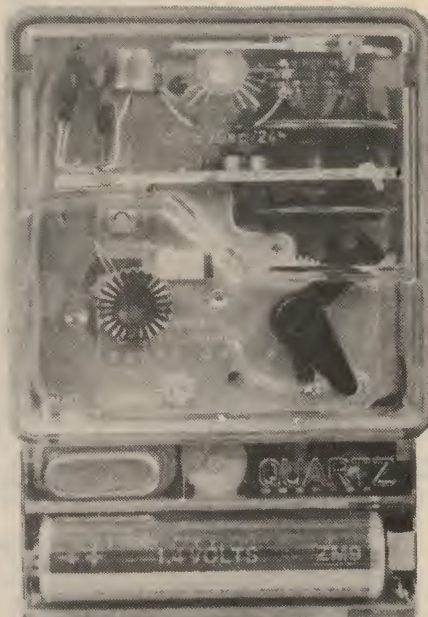
Crystal controlled clock

Australian Time Equipment Pty Ltd are importers of the French Vedette clock movements. A popular line has been the transistorised balance wheel movement which is fitted to different types of case to suit various environments. The movement operates from a single 1.5V dry cell with a life of from 12 to 18 months. Reliable operation is assured by the use of a transistor in the role of a solid state switch, instead of some other mechanical arrangement which cannot match the former for reliability.

The accuracy of this type of movement is such that it is possible to attain time keeping to within 40 seconds per week. This compares more than favourably with mantel type pendulum clocks.

In spite of the accuracy possible with this type of movement, there are many modern applications where this is just not good enough. In view of this an interesting development by Vedette is the modification of this movement so that it is brought under the control of a quartz crystal. By doing this, the accuracy attainable is enhanced markedly. Instead of the figures just quoted, it is possible, the maker's claim, to reach an accuracy of better than 1 minute per year at ambient temperature.

The crystal controlled unit is substantially the same as the earlier one but the case containing the complete movement has been altered to take the extra electronics. This includes a crystal on 327.68kHz, an IC and a 1.4V mercury cell.



A rear view of the Vedette crystal controlled movement, about half size.

The mercury cell has been substituted for the conventional 1.5V "C" cell presumably because the mercury cell maintains substantially a constant voltage throughout its useful life. This may be necessary to ensure correct operation of the IC with its division factor of 2^6 . With this division, the crystal frequency is brought down to 5Hz, which is a suitable

frequency for synchronising the balance wheel.

It is interesting to note that we at EA developed a method of synchronising transistor switched battery operated clock movements a couple of years ago. In fact, the movement which was used for the original work was a Vedette, the same as the one under review. While I have not delved right into the "works", the systems used appear to be the same.

We have had this unit under observation in our laboratory for several months and have found its time-keeping to be excellent. One second per month is not uncommon. There may be a variation of two or more seconds in some months. However, the maker's claim of 1 minute per year is conservative and something better than this is normal in practice.

Applications for this type of clock are almost endless, particularly where this sort of accuracy is required. Another particular advantage this unit has over synchronous clocks operated from the mains, is the fact that they do not require a power point for operation, making it quite independent of external leads.

While we are on the subject of crystal controlled timekeeping, Australian Time Equipment Pty Ltd also have a watch crystal on 32768Hz. This is an XY flexure bar in a metal case just under 17mm long x 5.2mm wide and 3.1mm thick. The crystal is designed for series operation. Further details of the crystal and clock movement may be had on application to Australian Time Equipment Pty Ltd, 192 Princes Highway, Arncliffe, NSW 2205. (I.L.P.)

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\$368.75 (Plus Tax)

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POPULAR KITS — TOP QUALITY — LOWEST PRICES

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- 1 Direct Reading A.F. Gen.
- 2 SQ Wave Gen-10Hz-1MHz.
- 3 Solid State A.F. Gen.
- 4 Additive Freq Meter.
- 5 A.F. Tone Burst Gen.
- 6 Laboratory Solid State A.F. Gen.
- 7 Scaler/Divider Unit.
- 8 Crystal Freq Calibrator.
- 9 Direct Reading A.F. Meter. (0-200KHz — 10MV-2V).
- 10 High Performance A.F. Gen.
- 11 White Noise Gen.
- 12 —
- 13 —
- 14 —

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- 15 Tacho & Dwell Angle for Service Stations.
- 16 Dwell Extender Unit.
- 17 Solid State — CDI.
- 18 All Electronic Ignition System.
- 19 Windscreen Vari-Wiper.
- 20 Tacho & Dwell Unit.
- 21 Brake Light Warning.
- 22 Emergency Flasher.
- 23 High Efficiency Flasher.
- 24 Solid State Volt Reg.
- 25 Car Theft Alarm System.
- 26 Ignition Analyser & Tachometer Unit.
- 27 Strobe Adaptor for Ignition Analyser.
- 28 Car Burglar Alarm.
- 29 —

BATTERY CHARGERS

- 30 6 Volt — 1 Amp.
- 31 12 Volt — 1 Amp.
- 32 Automatic H/Duty.
- 33 1-14 Volt — 4 Amp.
- 34 1973 Automatic Unit.
- 35 Constant Current Unit.
- 36 —
- 37 —

CONVERTERS — INVERTERS

- 38 12 VDC 300/600V 100W.
- 39 12 VDC 240 VAC 20W.
- 40 12 VDC 240 VAC 50W.
- 41 24 VDC 300 VDC 140W.
- 42 24 VDC 800 VDC 160W.
- 43 —
- 44 —

C.R.O. UNITS

- 45 1963 3" Calibrated.
- 46 1966 3" C.R.O.
- 47 1968 3" Audio C.R.O.
- 48 C.R.O. Electronic Switch.
- 49 C.R.O. Wideband P/Amp.
- 50 C.R.O. Calibrator.
- 51 —
- 52 —

INTRUDER WARNING SYSTEM

- 53 Electronic Thief Trap.
- 54 Infrared Alarm System.
- 55 Simple Burglar Alarm.
- 56 Light Beam Relay.
- 57 Car Burglar Alarm.

MULTIMETERS & V.O.M.

- 58 Protected D.C. Multimeter.
- 59 Meterless Voltmeter.
- 60 Wide Range Voltmeter.
- 61 F.E.T. D.C.
- 62 1966 V.T.V.M.
- 63 1968 Solid State V.O.M.
- 64 1973 Digital V.O.M. (1).
- 65 1973 Digital V.O.M. (2).
- 66 High Linearity A.C. Millivoltmeter.
- 67 —
- 68 —

PHOTOGRAPHIC UNITS

- 69 50 Day Delay Timer.
- 70 Regulated Enlarger Line.
- 71 Slave Flash Unit.
- 72 Sound Triggered Flash.
- 73 Solid State Timer.
- 74 Auto Trigger For Time Lapse Movies.
- 75 —
- 76 —

REGULATED POWER SUPPLIES

- 77 Laboratory Type 30/1 Unit.
- 78 Laboratory Type Dual Power Supply.
- 79 Serviceman's Power Supply.
- 80 Solid State H.V. Unit.
- 81 IC Variable Supply Unit.
- 82 1972IC Unit (E/T).
- 83 Simple 5V 1A Unit.
- 84 Simple 3-6V 3.5A Unit.
- 85 S/C Proof 0.30 VDC at 1A.
- 86 Reg 0.30VDC at 3A O/L Protected.
- 87 Variable Reg 12V-0.5A.
- 88 Reg O/Load & S/C Protection 60 VDC at 2A (1973) — EA.
- 89 —
- 90 —

R.F. INSTRUMENTS

- 91 Solid State Test Osc.
- 92 Signal Injector & R/C Bridge.
- 93 Solid State Dip Osc.
- 94 "Q" Meter.
- 95 Laser Unit.
- 96 Digital Freq Meter 200KHz.
- 97 Digital Freq Meter 70MHz.
- 98 IF Alignment Osc.
- 99 27MHz Field Strength Meter.
- 100 100KHz Crystal Cal.
- 101 1MHz Crystal Cal.
- 102 Solid State Dip Osc.
- 103 V.H.F. Dip Osc.
- 104 V.H.F. Powermatch.

- 105 V.H.F. F/S Detector.
- 106 S.W.R. Reflectometer.
- 107 R.F. Impedance Bridge.
- 108 Signal Injector.
- 109 1972 FET Dipper.
- 110 Digital Freq Meter.
- 111 Simple Logic Probe.
- 112 Frequency Counter & DVM Adaptor.
- 113 Improved Logic Probe.
- 114 Digital Logic Trainer.
- 115 Digital Scaler/Preamp.
- 116 Digital Pulse Probe.
- 117 Antenna Noise Bridge.
- 118 Solid State Signal Tracer.
- 119 1973 Signal Injector.
- 120 Silicon Diode Sweep Gen.

TRAIN CONTROL UNITS

- 124 Model Control 1967.
- 125 Model Control with Simulated Inertia.
- 126 Hi-Power unit 1968.
- 127 Power Supply Unit.
- 128 SCR-PUT Unit 1971.
- 129 SCR-PUT Unit with Simulated Inertia 1971.
- 130 Electronic Steam Whistle.
- 131 Electronic Chuffer.

TV INSTRUMENTS

- 134 Silicon Diode Sweep Gen.
- 135 Silicon Diode Noise Gen.
- 136 Transistor Pattern Gen.
- 137 TV Synch & Pattern Gen.

VOLTAGE CURRENT CONTROL UNITS

- 142 Auto Light Control.
- 143 Bright/Dim Unit 1971.
- 144 S.C.R. Speed Controller.
- 145 Fluorescent Light Dimmer.
- 146 Autodim-Triac 6 Amp.
- 147 Vari-Light 1973.
- 148 Stage, etc. Autodimmer 2KW.
- 149 Auto Dimmer 4 & 6KW.

RECEIVERS—TRANSMITTERS—CONVERTERS

- 153 3 Band 2 Valve.
- 154 3 Band 3 Valve.
- 155 1967 All Wave 2.
- 156 1967 All Wave 3.
- 157 1967 All Wave 4.
- 158 1967 All Wave 5.
- 159 1967 All Wave 6.
- 160 1967 All Wave 7.
- 161 Solid State FET 3 B/C.
- 162 Solid State FET 3 S/W.
- 163 240 Communications RX.
- 164 27 MHz Radio Control RX.
- 165 All Wave IC2.
- 166 Fremodyne 4-1970.
- 167 Fremodyne 4-1970.
- 168 R.F. Section Only.
- 169 110 Communications RX.
- 170 160 Communications RX.

- 170 3 Band Presetor.
- 171 Radio Control Line RX.
- 172 Deltahek MK2 Solid State Communications RX.
- 173 Interstate 1 Transistor Receiver.
- 174 Crystal Locked H.F. RX.
- 175 E/A 130 Receiver.
- 176 E.A. 138 Tuner/Receiver.
- 177 Ferranti IC Receiver.
- 178 Ferranti IC Rec/Amp.
- 179 7 Transistor Rec.
- 180 —
- 181 —

TRANSMITTERS

- 182 52MHz AM.
- 183 52MHz Handset.
- 184 144MHz Handset.

CONVERTERS

- 187 MOSFET 52MHz.
- 188 2-6MHz.
- 189 6-19 MHz.
- 190 V.H.F.
- 191 Crystal Locked HF & VHF.

AMPLIFIERS PREAMPS & CONTROL UNITS MONAURAL.

- 194 Mullard 3-3.
- 195 Modular 5-10 & 25 Watt.

STEREO

- 196 1972 PM 129 3 Watt.
- 197 Philips Twin 10-10W.
- 198 PM 10 + 10W.
- 199 PM 128-1970.
- 200 PM 132-1971.
- 201 ETI-425 Amp & Preamp.
- 202 ETI-425 Complete System.
- 203 ETI-416 Amp.
- 204 PM 136 Amp 1972.
- 205 PM 137 Amp 1973.

GUITAR UNITS

- 209 P/M 125 50W.
- 210 E/T 100 100W.
- 211 P/M 134 21W.
- 212 P/M 138 20W.
- 213 Modular 200W.
- 214 Reverb Unit.
- 215 Waa-Waa Unit.
- 216 Fuzz Box.

PUBLIC ADDRESS UNITS

- 219 Loud Hailer Unit.
- 220 P.A. Amp & Mixer.
- 221 P/M 135 12W.
- 222 Modular 25W.
- 223 Modular 50W.

CONTROL UNITS

- 225 P/M 112.
- 226 P/M 120.
- 227 P/M 127.

MIXER UNITS

- 229 FET 4 Channel.
- 230 ETI Master Mixer.
- 231 Simple 3 Channel.

TUNER UNITS

- 232 P/M 122.
- 233 P/M 123.
- 234 P/M 138.
- 235 Simple B/C.

PREAMPLIFIERS

- 237 Silicon Mono.
- 238 Silicon Stereo.
- 239 FET Mono.
- 240 Dynamic Mic Mono.
- 241 Dynamic Mic Stereo.
- 242 P/M 115 Stereo.
- 243 —

MISCELLANEOUS KITS

- 244 Geiger Counter.
- 245 Direct Reading Impedance Meter.
- 246 —
- 247 Electronic Anemometer.
- 248 Simple Proximity Alarm.
- 249 Pipe & Wiring Locator.
- 250 Resonance Meter.
- 251 Electric Fence.
- 252 Metronome Ace Beat.
- 253 Transistor Test Set.
- 254 Electronic Thermometer.
- 255 Flasher Unit.
- 256 Lie Detector.
- 257 Metal Locator.
- 258 Stroboscope Unit.
- 259 Electronic Canary.
- 260 240V Lamp Flasher.
- 261 Electronic Siren.
- 262 Probe Capacitance Meter.
- 263 Moisture Alarm.
- 264 AC Line Filter.
- 265 Proximity Switch.
- 266 Silicon Probe Electronic Ther-mometer.
- 267 Transistor/FET Tester.
- 268 Touch Alarm.
- 269 Intercom Unit.
- 270 Light Operated Switch.
- 271 Audio/Visual Metronome.
- 272 Capacitance Leakage.
- 273 Audio Continuity Checker.
- 274 Bongo Drums.
- 275 Simple Metal Locator.
- 276 Keyless Organ.
- 277 Musicolour.
- 278 Stereo H/Phone Adaptor.
- 279 Attack Decay Unit.
- 280 Tape Recorder Vox Relay.
- 281 Tape Slide Synchroniser.
- 282 Tape Actuated Relay.
- 283 Auto Drums.
- 284 IC Volt Compressor.
- 285 Audio Attenuator.
- 286 Thermocouple Meter.
- 287 Door Monitor.
- 288 Earth "R" Meter.
- 289 Shorted Turns Tester.
- 290 Zenor Diode Tester.
- 291 Morse Code Osc.
- 292 Simple Electronic Organ.
- 293 Pollution & Gas Analyser.
- 294 Universal H/Phone Adaptor.
- 295 Super Stereo ETI 410.
- 296 "Q" Multiplier.

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NEW PRODUCTS

Compact electronic thermometers

Convenience and reading accuracy are the features offered by "Mini-Z" electronic thermometers, made by Hokuto Electric of Japan. Both technical and medical versions are available, from Dick Smith Electronics.

The Mini-Z model 2N is intended for technical applications, such as measurement of transistor and heatsink operating temperatures. It has a range of from -10°C to $+80^{\circ}\text{C}$, with the scale calibrated in degree divisions. The alternative model C instrument is intended for medical work, covering the range from 32°C – 42°C (90 – 108°F) with 0.1°C scale divisions (0.2°F divisions).

Both instruments are housed in plastic cases measuring $145 \times 92 \times 42\text{mm}$, the only difference being colour—that for the model 2N is black, while the model C case is white. The cases appear to be made from "Cyclocac", or a similar impact resistant plastic.

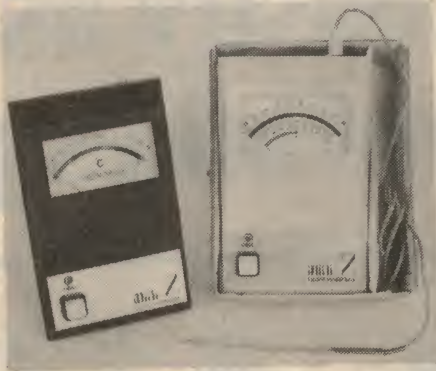
The instruments employ thermistor probes, which connect to the meter cases via cables and 3.5mm plugs. Each instrument comes with an appropriate probe, although additional and specialised probes are available. The instruments are battery operated, the model 2N requiring a single "AA" penlight cell while the model C uses a miniature 9V battery. Both instruments have a calibration adjustment to allow for battery ageing.

Measurement accuracy of the model 2N instrument is claimed as $\pm 1^{\circ}\text{C}$, while that of the model C is claimed as $\pm 0.1^{\circ}\text{C}$ ($\pm 0.2^{\circ}\text{F}$). Time of response of the model 2N with the probe normally supplied is 7 seconds, and the same figure applies to the model C.

Tested in our laboratory, the sample model 2N proved itself a very handy instrument, easy to use and with an accuracy within that claimed.

We passed the sample model C instrument over to a general practitioner friend, to try it in a realistic clinical environment. His reaction was that while it appeared to have adequate accuracy, there were a number of negative features compared with a conventional clinical mercury thermometer. It wasn't any faster than the mercury type, for accurate readings, yet unlike the mercury type it doesn't hold its reading, so that readings must be taken very rapidly. There is no provision for interchangeable tips, either, so that sterilisation would pose a problem in a busy surgery.

Not only this, but there is the added problem of having to tweak the calibration adjustment periodically, to ensure accuracy, and of remembering to replace the battery. In short, the model C seems best suitable for relatively casual use, perhaps in the home.



At left is the model 2N thermometer, with the medical model C at right.

At a price of \$29.75, the model 2N represents attractive value for money, as a useful workshop instrument. The model C is slightly lower in cost at \$29.50, but may be less attractive in view of its limitations. Both prices are plus \$1.50 post and packing if applicable.

Further information from Dick Smith Electronics Pty Ltd, 162 Pacific Highway, Gore Hill, NSW 2065. (J.R.)

Etch resist pen

Those who need to produce custom PC boards rapidly should know about the DALO type 33PC marking pen, specifically designed for this purpose. It incorporates a special valve-controlled ink dispenser to control the etch-resist ink and prevent evaporation. Etching is possible 15 minutes after drying.

The pen, ink solvent and solvent dispenser are available from Royston Electronics Pty Ltd, 22 Firth Street, Doncaster, Vic.

Multi-tap 40VA transformer

As a result of the response to the 20VA multi-tap low profile transformer model PL1.5-18/20VA added to their range a few months ago, Ferguson Transformers have produced a similar unit rated at 40VA. Conforming to the requirements of AS C126, the new transformer provides the same range of output voltages as its smaller brother: from 3V CT to 18V CT in 1.5V steps, at a current of 2.2A. It carries the type number PL1.5-18/40VA.

Both multi-tap transformers should be available via normal suppliers, or from Ferguson Transformers Pty Ltd.

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69 Buchanan Avenue, North Balwyn,
Vic. 3104 P.O. Box 162. Ph. 85 4061

ELECTRIC MOTOR SPEED CONTROLLERS

Complete ready to use and S.E.C. approved. Suitable for any ac/dc brush type 240 volt motor, especially drills and other hand tools. Controls speed down to stop without loss of torque. Capacity 2500 watts. 10 amp. Price including cert. post \$25.00

BASIC KIT TO BUILD ABOVE CONTROLLER

Contains triac, resistor, pot knob, diodes, 3 pin base, 3 pin plug and circuit.
Three amp. capacity. \$7.95
Ten amp. capacity \$9.50
Prices include postage.

BASIC LAMP DIMMER KIT

For controlling incandescent lamps from full to out. Capacity up to 1000 watts. Contains triac, diac, pot, knob, capacitors, resistors, ferrite rod inductor and circuit.

\$6.95
Price including postage.

PLASTIC CABINETS

Suitable to contain above speed controller and lamp dimmer. Approx. size— $117 \times 62 \times 35\text{mm}$.

\$1.45
Price including postage.

METERS. MOVING IRON

0-10 amp. ac/dc. Clear plastic face approx. $55 \times 55\text{mm}$.

\$4.75
Price including postage.

BASIC BATTERY CHARGER KIT

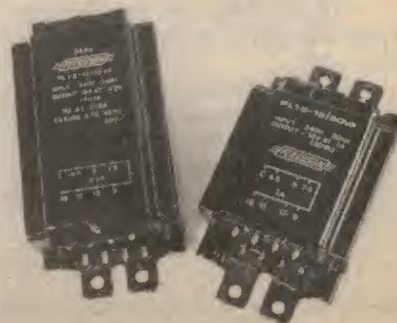
For charging 12 volt batteries at 2 amp. Consists of transformer, bridge, rectifier, ballast resistor and circuit.

\$9.25
Plus postage \$1.00.

BASIC BATTERY SAVER KIT

Use instead of batteries in radios, tape recorders, record players, instruments etc. Consists of tapped transformer, bridge rectifier, filter capacitor and circuit.

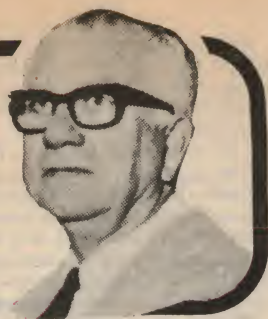
Will supply dc voltages from 6 to 15.
One amp. size. \$8.75
including postage.
Two amp. size. \$14.25
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98 ELECTRONICS Australia, September, 1975

The Amateur Bands

by Pierce Healy, VK2APQ



Future of amateur radio societies

What future is there for amateur radio societies? A question which must concern all amateurs if such organisations are to flourish and continue to provide services needed by members.

At the outset, it must be emphasised that any society, be it a voluntary or paid organisation, can only be as strong and effective as members make it.

With changing patterns of behaviour, outlook, attitudes and values, it is difficult to predict what the future of national amateur radio societies will be. Several are already finding that rising costs and world economic trends are causing problems.

Amateur radio, being a technical self educational, self policing, and international activity, fostered the formation of radio clubs and later national societies. In most cases the work of radio clubs is on a voluntary basis. This also applies to the smaller national societies while the few large national societies employ staff to carry out routine management and clerical tasks. However, in general, the executive officers appointed by members do not receive any reimbursement for their work.

Sharply rising charges for printing, postage, telephones, etc, has increased the cost of providing services to members. To offset some of these additional costs, magazines produced by some of the overseas societies have been reduced in size. In some cases increased charges passed on to advertisers has reduced the volume of advertising that business houses are willing to undertake.

The inevitable rise in subscription rates is too often followed by a fall in membership. Sometimes such persons rejoin, but what should be a natural growth rate in membership does not occur.

This is a phenomenon which is happening in Australia as well as other parts of the world. Unfortunately, at a time when the strongest possible organisation is needed, we cannot say that the WIA represents the majority of amateurs in Australia.

The situation in Australia is an interesting one. For more than 50 years the WIA, the oldest national amateur radio society in the world, was operated with an absolute minimum of paid staff. In the 1960's the two largest divisions, NSW and Victoria, employed clerical assistance to carry out the every-day work. This was more on a part time basis. As far as federal executive was concerned all duties were carried out voluntarily by the officers elected. Part time secretarial duties were in most instances done by an employee of a federal executive member, who no doubt subsidised any charges to the Institute.

Up to the beginning of the 1970's each division maintained independent membership and accounting systems. Only membership figures and per capita payments were passed to federal executive.

But the 70's have seen changes within the federal organisation. In 1971 a manager was appointed, ostensibly to work on the Institute's monthly magazine (until then done voluntarily) and also as a part time assistant to federal executive.

Since then, the federal body has been incorporated, all membership records computerised, all mem-

bership subscriptions paid direct to federal executive and divisions reimbursed by federal executive, and publication of the magazine, formerly a function of the Victorian division, has become the responsibility of federal executive. During the same period operating charges have risen considerably and the salaries bill now amounts to \$20,000 a year.

At the beginning of 1970, 54% of all licensed amateurs in Australia were members of the WIA. The total membership (all grades) was 4495. Membership fees were \$7.00 in NSW with slight variations in other states.

At the beginning of 1975 the number of licensed amateurs who are members of the WIA dropped to 50%. The total membership (all grades) was 4513, an increase of 18 over the five years. During the same period the total number of licences increased by 937. Statistics show that the number of licensed members increased by 251, the number of non-licensed members dropped by 233. It is possible that a fair percentage of non-licensed members had gained their licence and changed membership grade.

Now a membership subscription fee of \$20 to \$25 a year is being mentioned for 1976.

These cold facts indicate that the future of the WIA can only be secure if amateurs are willing to pay for tasks to be carried out on their behalf, or revert to the tried and proven voluntary effort system. The latter is more economical financially but requires dedicated volunteers—not egoists—for it to operate successfully.

After all, voluntary effort over 50 years provided a good foundation upon which to build and expand.

A final point; when considering what the future holds for amateur radio societies, remember that in 1979 all amateur bands will come under review by the International Telecommunication—World Administrative Radio Conference in Geneva. It will be essential for a strong national society to make representation on your behalf.

Voluntary effort on the part of WIA officers in 1959, the year of the previous WARC, saved many facets of amateur radio from annihilation.

What are you prepared to do to repeat that performance?

LOCAL AND OVERSEAS NEWS ITU NEWS

The 2nd World Telecommunication Exhibition will be held in Geneva, Switzerland from 2nd to 8th October, 1975. The first exhibition was held in 1971. Both were sponsored by the International Telecommunication Union.

More than 300 exhibitors from about 40 countries will be participating. In conjunction with the exhibition there will be "Youth in the Electronic Age"

competition and, on 4th and 5th October, there will be a "World Radio Amateur Convention".

Speaking at a press conference attended by representatives of many exhibitors, Mr Richard E. Butler, Deputy Secretary-General of the ITU said; "TELECOM 75 is not just an exhibition of equipment. It caters for all—the policy maker, economist, engineer, scientist, the future personnel of communications, the young, the user and the public at large".

Travellers to Europe may take the opportunity to visit the exhibition and see the latest in all types of electronic equipment. If an amateur, there is the opportunity to attend the World Amateur Radio Convention.

SWISSAIR, has been designated official carrier for TELECOM 75. Full information may be obtained from their agencies.

SOUTH WEST ZONE CONVENTION

An invitation is extended to all amateurs and their families to attend the NSW Division WIA South West Zone Convention at Deniliquin in the heart of the Southern Riverina.

Date: Saturday 4th and Sunday 5th October, 1975.

Location: Memorial Park and adjacent Legion Hall, 80 m from the centre of Deniliquin.

Program details—Saturday:

- 9.00 am 40 metre contest (see details below).
Registrations; Talk-in 2M FM on channel 40.
Bring own lunch.
- 2.00 pm 146MHz hidden transmitter hunt.
- 3.00 pm Not so hidden 146MHz transmitter hunt, bring your super sensitive sniffer.
- 4.00 pm Visit to 2QN Broadcast Station studio to see "Fifi" rave on.
- 7.00 pm Assembly prior to dinner.

Note: Throughout the afternoon a variety of contests and activities to entertain wives, children and non-competitors will be provided. After dinner activities will include films and an auction of surplus components or equipment.

Program details—Sunday:

- 10.00 am VHF Scramble—2M FM and 2M AM—prize for each section.
- 10.30 am 146MHz fox hunt.
- 12.30 pm Barbeque type lunch.
- 2.00 pm HF transmitter hunt. Frequency to be advised.
- 3.00 pm 2M AM transmitter hunt on 144.1MHz. You will need your super sniffer and lots of luck.
- 4.00 pm Judging of best home built piece of gear, also best decorated cake with amateur radio (flavour?).
- 5.00 pm Prize presentation.
- 6.00 pm Barbeque tea, available at site followed by films.

Note: Contests and other activities will be provided throughout the day for wives, children and other non-competitors.

Registration fees: Family—\$4.00
Single—\$3.00

Rules for contest between amateurs attending the convention.

Duration: 9.00 am to 2.30 pm.

Frequency: 7095kHz or nearest clear channel.

Aim: For both mobile and base station operators attending the convention to contact each other as many times as possible subject to the following:

1. Stations can be reworked providing each contact is more than 30 minutes apart.
2. Points cannot be claimed for having worked stations not registered as attending the convention.
3. Base station, mobile or portable operation is allowed during the contest, with all points claimed being entered on the same log sheet. All points are additive.
4. Standard 59001 type scoring. Legible log sheet showing stations worked; times, points claimed, etc., to be handed in by 3.30 pm on Saturday 4th October, 1975.
5. Operators may continue to score up to 2.30 pm provided operation takes place in excess of one mile from the convention site.
6. Scoring for working the convention base station

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR BANDS

will be permissible only after a special "CQ South West Contest" call is given by the base station operator.

Scoring:— Contacts between—	
Base and Base	1 point
Base and mobile	2 points
Mobile and base	2 points
Mobile and mobile	3 points
All contacts with convention base station	3 points

The convention base station will be monitoring 7095kHz and adjacent channels to provide information for visitors, for HF talk-in, and general participation in the 40 metre contest.

Accommodation at Deniliquin will be in great demand during the holiday weekend. Suggest that inquiries be made early. Information may be given on the South West Zone net on Monday nights at 8.00 pm, frequency about 3570kHz.

There is plenty of space available for those bringing their own caravans.

Full details from The Secretary, WIA South West Zone Convention, C/- PO Box 312, Deniliquin, NSW 2710.

RADIO CLUB NEWS

RADIO CLUB DIRECTORY
A REMINDER THAT 16TH OCTOBER IS
THE DEADLINE FOR INCLUSION IN
DECEMBER 1975 ISSUE. FOR FORMAT
SEE LAST MONTH'S NOTES.

ST GEORGE AMATEUR RADIO SOCIETY: From Noel Spratt, VK2SBN, publicity officer. The St George repeater is nearing completion inasmuch as it is undergoing on-air tests and final adjustments.

Gary Herden, VK5ZK, president of the South Australian Division, WIA, attended the July, 1975 meeting. At the same meeting, Geoff Moss, VK2AHK, gave an interesting discourse on SSB transceivers. Geoff is the sole agent for Swan equipment in Sydney.

Monthly meetings are held on the first Wednesday of each month at the Civil Defence Headquarters, Highgate Street, Bexley.

HIGH FREQUENCY NETS: Two HF nets have been established in Sydney. They use CW, AM and SSB on 27.125MHz and 28.5MHz. The nets cater for mobile, portable and base station operation. A secondary frequency of 28.10MHz has also been proposed, for use when novice licensees obtain their full licence as it will require only minor modification to their existing novice band equipment. It is also hoped that DX contacts can be promoted through the use of these as calling frequencies.

Plans are also in hand for a net on 1.825MHz in the 160 metre band. The Sydney group would like to see interstate as well as local amateurs keep a listing watch on these frequencies.

Sam Voron, VK2BVS, would like to hear from those interested in promoting the use of these net frequencies.

GOLD COAST RADIO CLUB: The GCRC continues to attract visitors and new members. One visitor was B. Sutherland, ZL2AZQ from Nelson, New Zealand.

At least six GCRC members were preparing for the novice licence examination and VK4FE has offered a prize of \$10 to the first to receive a novice licence.

A lot of work has been done on the repeater installation at Mt Tamborine.

For information about the Gold Coast activities, join the VK4WIG net on 3650kHz each Sunday night between 2000-2030EST.

ILLAWARRA AMATEUR RADIO SOCIETY: At a very well attended general meeting in June, 1975 it was unanimously agreed that the group cease to be called the Illawarra Branch WIA, and in future be known as the Illawarra Amateur Radio Society. The move is the outcome of careful consideration by the local committee and discussions with the NSW divisional council, WIA. For details contact the secretary, PO Box 110, Dapto, NSW 2530.

CENTRAL COAST AMATEUR RADIO CLUB: The club has agreed to set up a station to demonstrate amateur radio at the Erina Heights School, near Serpentine Road, on Saturday 16th August, 1975. Dick

Maitland, VK2BBK is co-ordinating activities. It is expected that in addition to static displays there will be active HF and VHF stations, and amateur TV.

Vaughan Wilson, VK2VW CCARC member had a busy time during the "big wet" at the end of June, 1975. Vaughan is the Wyong Shire Civil Emergency officer. The club's WICEN group under Ray Wells, VK2ZXS were also on the job.

Working bees are improving the acoustics of the operating room at the club. Plans are being finalised for participation in the Jamboree-on-the-Air in October and the annual field day to be held in February, 1976.

Club meetings are held on the 1st and 3rd Friday evenings of each month at Dandaloo Street, Kariang. Postal address is PO Box 238, Gosford 2250.

ACT DIVISION WIA: To cover the ACT division's share of meeting the deficit facing the WIA federal body, a levy of \$3.50 per member has been struck. This decision was reached at the May meeting following a report on the 1975 federal convention given by Eddie Penikis, VK1VP, federal councillor for the division.

Following questions asked in the Senate regarding communications with Darwin during the 1974 cyclone, the committee decided to send a resume of amateur participation to the appropriate members.

For details of the ACT division, write to the Secretary, PO Box 1173 Canberra City 2601.

GEELONG AMATEUR RADIO-TV CLUB: Taking a newspaper reporter on a hidden transmitter hunt gave the GARC some good publicity. From the story in the Geelong Advertiser it seems that quite an impression was made on the reporter. As amateur radio needs all the good publicity it can muster, GARC's initiative is worth imitating.

Club details from the secretary PO Box 520, Geelong 3220.

MOORABBIN & DISTRICT RADIO CLUB: The modular approach to home-built equipment was demonstrated to members by Harold Hepburn, VK3AFQ at a recent club meeting. Harold has designed ten modules on printed boards to cover the most common functions in a transceiver. These can be used either alone or combined. On display were samples of the modules together with circuit details, also a complete SSB transceiver with digital readout. The digital readout costs less than a conventional dial, due to the use of digital IC's.

The MDRC postal address is PO Box 88, East Bentleigh, 3165.

LADIES' AMATEUR RADIO ASSOCIATION: This association has been formed in Victoria and has affiliated with the WIA.

It is understood that the aim is to foster a more active interest in amateur radio, not only among the ladies already licensed but also among the wives and friends of amateurs.

Among the plans outlined are local and nationwide nets and field day contests. Until more information comes to hand, keep a lookout for LARA nets and news on WIA broadcasts.

WESTLAKES RADIO CLUB: An enthusiastic party of eight WRC members and members of the University of NSW short-wave listeners group, set up a weekend camp at the Bar in the Wattagan Ranges west of Newcastle. From that location they participated in the 1975 Mid-Winter Field Day. Driving conditions to the site were made difficult due to recent rain and the first snow fall in the area for ten years.

During the Saturday night 14mm of frost turned into ice on the vehicles and Sunday night saw heavy rain. However, operating under the club's call sign VK2ATZ, the group were able to make thirty contacts during the contest.

More younger persons are attending the club for the first time on Saturday afternoons. Classes for student members are held on Saturday afternoons, and classes for the amateur licence are conducted by Keith Howard, VK2AKX, on Monday and Wednesday evenings. Theory notes for the evening classes are supplied to those attending.

For details call at the club during the periods stated or write to the secretary, Eric Brockbank, VK2ZOP, Box 1 PO Teralba, NSW 2284.

MAITLAND RADIO CLUB: Sixteen members of the club were candidates at the radio examinations

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Shortwave Scene

by Arthur Cushen, MBE



A new station operating on 6185kHz and announcing as Radio Swan is understood to be broadcasting from Swan Island in the Carribean. Programming is in Spanish, with reception best heard around 0700GMT.

Swan Island is a former American possession off the coast of Cuba. In the mid-1960's it was the site of a powerful radio station with the slogan "Radio America", and beamed programs around the clock to Cuba. The actual operation of the company which owned the station was never disclosed, but it was thought to be a CIA operation. Verifications from the station stated that it operated on 1160kHz with the power of 50kW, and had a shortwave transmitter of 7.5kW on 6000kHz.

The new Radio Swan broadcasts in Spanish on 6185kHz and is best received around 0700GMT. The program consists of popular Spanish music with announcements after each recording that indicate the station operates on both medium wave and shortwave. Transmissions are beamed to Cuba.

The Island of Swan was recently handed to Honduras by the American Government, and it is presumed that the old Radio American transmitters have been reactivated.

The announcement in Spanish does not give an address or location of the station, but simply identifies as Radio Swan. According to our reception the station appears to operate 24 hours a day as it still can be received past 0900GMT. The time announcements indicate that they are using Central American time.

ENGLISH FROM RADIO CAPITAL

A new program about Costa Rica is now broadcast by Radio Capital in San Jose on 4832kHz from 0700-0730GMT. Though this program is in Spanish, an English announcement has been heard by Chris Davis of Featherston NZ which indicates the station is using a new address. The program called Aqia Costa Rica includes an appeal for reports. Listeners should write to PO Box 2936, San Jose, Costa Rica.

According to the announcement the same program is carried on 6006kHz by Radio Reloj, which is owned by the same company. Signals in New Zealand are good during the period of reception. The English announcement is heard around 0720GMT.

VOICE OF TURKEY

The Voice of Turkey is now using a new frequency for its English transmission from 2200-0115GMT. Broadcasts are now heard on 15165kHz, which replaces 11320kHz, and on the old channel of 9515kHz.

The new channel provides good reception. The program includes news on the hour, with the balance made up of Turkish music, popular music and a jazz program. There is slight sideband on 15165kHz from Radio Australia on the nearby frequency of 15160kHz. At 0100GMT, the station has news and a press review before sign-off at 0115GMT. There is a DX program each day (except Sunday) at 2215GMT. Reports should be sent to: The Voice of Turkey,

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for West, 10 hours for East and 12 hours for NZT.

Turkish Radio and Television Corporation, Mithat-pasa Cad. NO. 37, Ankara, Turkey.

Overseas services from the Turkish Radio and TV Corporation originate from Ankara, with the transmitters sited at Etimesgut, just outside Ankara. Transmitters of 100kW and 250kW are in use.

DX SESSION RETIMED

The DX Session broadcast over the External Service of Radio New Zealand has been retimed for the first transmission. The DX World program is now heard at 0745GMT on the first Wednesday of each month, an hour later than previously. The session is repeated at 1030GMT (beamed to Australia) and again repeated the following Saturday at 2315GMT.

The session, which has been broadcast by Radio New Zealand since 1961, is known as Arthur Cushen's DX World. It is also carried on the National Stations of Radio New Zealand on medium-wave on the second Thursday of each month at 1230GMT.

YEMEN VERIFIES

One of the few verifications ever reported from Radio Yemen has been received by Gary Butler of Wellington NZ. Radio Sanaa in the Yemen Republic confirmed reception with a letter in English signed by Hussein Nu-nu, Technical Director.

Radio Sanaa has been operating for many years on 5805kHz, but in recent months a second transmitter has been put into service. John Mainland of Wellington NZ reports reception on 7300kHz around 1400GMT, with some interference from a Russian transmitter on the same frequency.

BUDAPEST'S 50 YEARS

The commencement of radio broadcasting in Hungary is nearing its 50th anniversary. In 1925, the construction of the PKI 2kW transmitter began on Csepel Island in Budapest, and regular programs commenced on the 1st of December, 1925. Although that was the beginning of regular broadcasting, experimental work had been going on previously for quite some time.

At the commencement of operations, Radio Budapest had 15,000 subscribers. The majority of these were amateurs who had built their own receivers and even made the parts themselves. In one year's time the number of subscribers had risen to 50,000. The next step saw the commissioning of modernised 20kW equipment which began transmitting the programs of Radio Budapest II. Unfortunately, the Second World War completely demolished the equipment of the Hungarian Radio. The withdrawing Nazi troops not only blew up installations, but in many cases dismantled the equipment. By the end of the war, the country was without any radio station whatsoever.

Radio Budapest was first heard again on 1st May, 1945. By the end of 1948, the Hungarian Standard Factory had built new 135kW equipment, which has been functioning without interruption ever since.

The 314 metre antenna tower was rebuilt and Budapest II was reconstructed at a new location in Szolnok, also with a capacity of 135kW. This transmitter is also used for broadcasting to foreign countries on medium-wave.

Four shortwave transmitters of 100kW each, one transmitter of 15kW, and two of 250kW are broadcasting at the present time in six languages—English, Spanish, German, Italian, Greek and Turkish. The two 250kW shortwave transmitters were put into operation in 1974.

MEDIUM WAVE NEWS

AUSTRALIA: Station 4WK Warwick, Qld, has made a frequency move from 880kHz to 960kHz. This change took place in May and the frequency has been cleared so that 4BH Brisbane, at present on 1390kHz, can move to 880kHz. Due to extensions to Brisbane's airport the transmitter site of 4BH is to be changed to Wynnum West. The frequency change will not take place until transmissions commence from this new site. The new Canberra commercial station 2CC will operate on 1390kHz and the opening date is now scheduled for October 1.

DUBAI: A verification has been received confirming our reception of Dubai on 1480kHz. The power listed is 600kW. The station's address is: PO Box 1695, Dubai UAE.

NEW ZEALAND: 2XW Radio Windy, Wellington, is reported in the New Zealand DX Times as hoping to change frequency from 1080kHz to 890kHz in an effort to improve its coverage in the Hutt Valley and Golden Coast. If this move doesn't prove successful, repeater stations will be considered.

LISTENING BRIEFS EUROPE

USSR: Radio Vilnius in Lithuania has two English transmissions beamed to Europe and North America. According to the BBC Monitoring Service the transmission from 2230-2300GMT is broadcast on 9685, 9735, 9745 and 11770kHz. The second transmission from 0030-0100GMT is on 9505, 9685 and 12000kHz.

HUNGARY: Radio Budapest is now broadcasting its special program for the shortwave listener at new times. The transmission to Europe is broadcast on Tuesdays and Fridays from 1515-1530GMT on 6025, 7175, 9585, 9833, 11910, 15125 and 17780kHz; and to North America on Wednesdays and Saturdays from 0400-0415GMT on 6000, 7250, 9585, 9833, 11910, 15220 and 17710kHz.

ASIA

YEMEN: Radio Yemen has been heard opening at 0300GMT on 9585kHz. The signal is weak in New Zealand and the transmission suffers from sideband interference from stations on 9580 and 9590kHz.

BANGLADESH: Radio Bangladesh has been heard by the BBC Monitoring Service on a new frequency of 9633kHz for the evening transmissions to Europe, including the 1815-1915GMT English program. This is in addition to 9488, 7380, 7250 and 5826kHz used between 1600-1915GMT.

MONGOLIA: Radio Ulan Bator has been heard by John Mainland of Wellington, NZ, with its English language service at 2200GMT. The program consisted of an interval signal, station identification, news, and then a talk until sign-off at 2230GMT. The frequency used at this time was 11810kHz.

AMERICAS

ARGENTINA: According to Sweden calling DXers, Radiofusion Argentina al Exterior, Buenos Aires, broadcasts to Europe, Africa and the Middle East from 1900-2350GMT on 11710kHz. The English broadcast is from 2300-2350GMT. Transmission to the Americas is from 2400-0700GMT with the last hour of the transmission being in English on 9690kHz.

BRAZIL: Many stations in Brazil operating in the 60 metre band have made frequency changes. Radio Central Brazil is now operating on 4985kHz and has been heard by Chris Davis of Featherston, NZ, closing around 0530GMT. This station has changed frequency from 4995kHz.

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C45	2.10	2.00	1.90
C60	2.30	2.15	2.00
C90	3.20	3.00	2.80

TDK

C45 LN	1.80	1.70	1.60
C60 LN	1.95	1.85	1.75
C90 LN	2.80	2.60	2.40
C180 LN	5.45	5.30	5.05
C90 SD	3.65	3.45	3.25

CONCORDE

C60	1.20	1.10	1.00
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C90 LN	2.55	2.25	2.05
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BRA 121



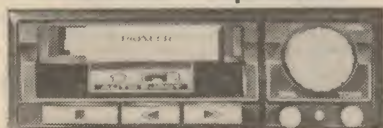
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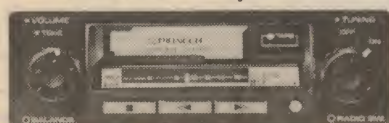
\$109.00 + speakers



PIONEER KP4000

AM/FM-MPX car stereo radio 8 watts RMS

\$185.00 + speakers



HITACHI CS2000



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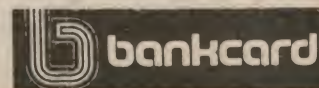
\$115.00
with speakers

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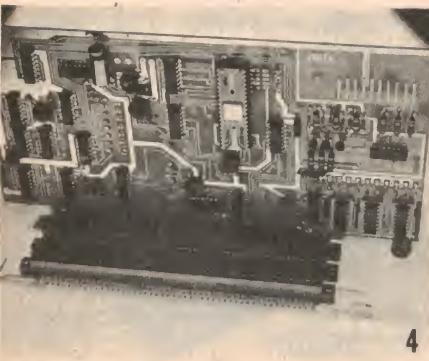
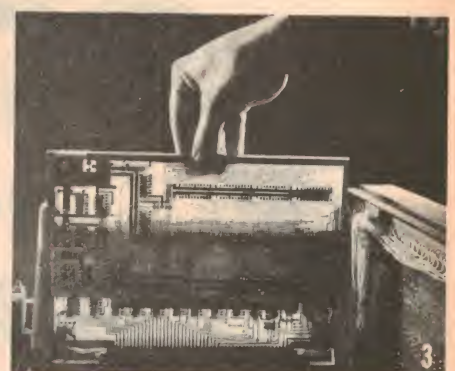
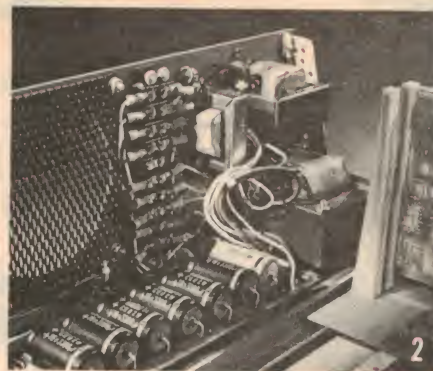
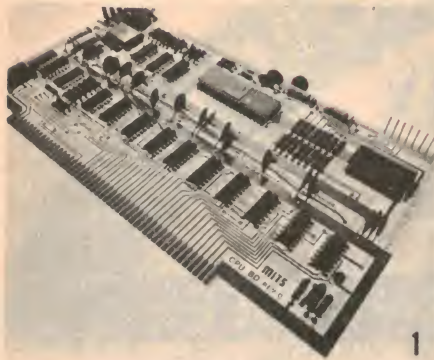
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See also our advertisement in E.A., August, '75.



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2. Power Supply. The Altair Power Supply provides two +8, a +16 and a -16 volts. These voltages are unregulated until they reach the individual boards (CPU, Front Panel, Memory, I/O, etc.). Each board has all the necessary regulation for its own operation.

The Altair Power Supply allows you to expand your computer by adding up to 16 boards inside the main case. Provisions for the addition of a cooling fan are part of the Altair design.

3. Expandability and custom designing. The Altair has been designed to be easily expanded and easily adapted to thousands of applications. The basic Altair comes with one expander board capable of holding four vertical boards. Three additional expander boards can be added inside the main case.

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INFORMATION CENTRE

RC BRIDGE: I have enclosed a crude diagram of the front panel of an RC bridge that I have acquired. It has a few components missing, and I hope to fix it and use it for finding the values of unmarked components. It looks home made, and I thought it might be one of the projects in Electronics Australia. It runs off 240V AC, and has two nine-pin valves. If it is one of your projects, could you publish the date of the edition in which it appears, and the price of any reprints available? (R.S., Toukley, NSW).

● Your diagram was not too crude for us to be able to recognise the Resistance-Capacitance Bridge, featured in the September 1963 edition of "Radio, TV and Hobbies". The File No. is 7/B/7, and a reprint is available for \$2.00, including postage.

GUITAR PREAMPLIFIER: I am designing a preamp for a guitar amplifier which will have inputs for lead, rhythm and bass guitars. However, I need to know the output voltage of the pickup heads in these guitars and also need to know the impedances of the heads. (S.G., Tauranga, NZ.)

● Guitar pickups can have an output signal of less than 10 millivolts for a lead guitar to substantially more than 100 millivolts for a bass guitar, depending also on how hard the strings are struck. We cannot quote figures for the impedance of guitar pickups but most guitar amplifier designs provide load impedances of about 50k to 100k. We have published several solid-state guitar amplifiers and preamplifiers in the past which may be useful references for you. "Preamplifier for electric guitars", October 1968, File 1/GA/13 and "Playmaster 138 Guitar Amplifier", May 1973, File 1/GA/20 are representative of these.

TRAIN CONTROLLER: I would like to thank you for the Model Train Controller of May 1974. I have just built it and it works extremely well. The inertia is so realistic and reliable and there is no more starting trains with fingers, the built in "kick" is very satisfactory. I am so pleased with the result that I am going to build two more and scrap the old controls I have been using.

What happens if, through points switching the output of one controller presents itself at the emitter of the 2N3055 of another control? Will I need to isolate each controller in turn by the switches as the points change, or do I use diodes to isolate the controllers from each other?

I made my unit from components on hand, except the two transistors, and when complete I could get only 2V at the track. After much checking I found that diode 4 had shorted. Others, with limited knowledge like myself, might spend as much time as I did looking for such a fault. My experience might save them a couple of hours fruitless searching.

Thank you for a brilliant and uncomplicated circuit. (D.H., Christchurch, NZ.)

● Thank you for your kind remarks D.H., and we are glad to learn that you have found the controller to be such a good performer. Having played with it ourselves, we think so too!

Your question about controllers being connected together raises a number of points. First, there is the matter of polarity. In the event (hopefully rare) that two controllers are connected with opposing polarity it is probable that each will behave as if looking into a short circuit, and the circuit protection should prevent any damage.

If the polarities are the same there is the possibility that the maximum permissible base/emitter voltage will be exceeded on one or both 2N3055s. Your suggestion of a diode appears to be a good one, although we haven't tried it. A heavy duty diode, such as a BY126 could be connected directly in series with the emitter, prior to the reversing switch. Since we have not had a chance to try this, we cannot comment on any subtle side effects which might arise. Perhaps you could let us—and other readers—know how it works out.

Thank you for the comment about the shorted diode. It emphasises the desirability of being able

to test all components—even new ones—before fitting them.

CASSETTE DECK: I have a rather small but frustrating problem and would appreciate it if you could give me a satisfactory answer. I have a stereo cassette deck and just recently purchased the Playmaster 136 amplifier.

I have read in many magazines that a cassette deck should not be kept anywhere near a magnetic field because in time the heads become magnetized and this affects volume or tone reproduction. The problem is whether or not it would be safe to keep the deck on top of the amplifier which has a transformer which produces a magnetic field around it.

If I do keep the deck on top of the amplifier, is the magnetic field around the transformer strong enough to harm the heads in any way? (G.B., Fulham Gardens, SA)

● It is unlikely that the magnetic field around your amplifier's transformer could even partially magnetise your deck head. However, it is much more likely that the field will react with the head to induce hum into the playback circuitry and thus worsen the signal-to-noise ratio. If you do not like hum, keep the deck off the amplifier.

ORGAN KITS: I have been reading your magazine for many years and I find it very interesting. Perhaps I may be able to help some of your organ enthusiasts. Many enthusiasts spend a lot of time, money, and effort to build an organ, which often costs more than a ready built one, yet has an inferior finish and cannot be sold.

I have just come across a kit which solves most of these problems. It is based on a building block concept and, if he wishes, the builder can start in a very small way and add to the organ as he can afford it.

Construction is simple and the completed organ is quite glamorous. I have just completed an organ from a kit imported from a firm called Bohn in Minden, Germany. The kit cost me \$2000 plus \$200 for freight from Minden to Melbourne port. I did not have to pay import duty. The instructions were printed in German and I do not know whether English instruction manuals are available. The firm's full name and address is: Dr. Bohm, D595 Minden (Deutschland), Postfach 209, Kühlenstrabe 130-132. (S.E.S., Glen Waverley, Vic.)

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: \$2 per project, or \$2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at \$2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: \$2. Specify positive or negative. We do not sell PC boards.

REPLIES BY POST: Limited to advice concerning projects published within the past 2 years. Charge \$2. We cannot provide lengthy answers, undertake special research or discuss design changes.

● Thank you S.E.S. for all the information (which we have had to abridge somewhat). Included was a large catalogue which, while printed in German, was most impressive. We imagine these kits would have a lot of appeal to Australian readers if they could overcome some of the delivery and language problems.

PLAYMASTER CASSETTE DECK: There still appears to be some confusion about component values for your Playmaster 144 Cassette Deck. The playback preamplifier published in November 1973 (File No. 1/PRE/28) shows the circuit with output capacitors of 4.7uF. However, the October 1974 article on the cassette deck (File 1/RA/31) shows the circuit on page 35 with the output capacitors as 47uF. Your addendum article still shows the capacitor as 47uF. To date no reference to this drastic change can be found. Your addendum also replaces the 1.5M bias resistor with 1M, without reference. Would you kindly clarify these values in your next edition. (A.O., Proserpine, Qld.)

● The reason for the "drastic change" in output capacitor values from the original circuit published in November 1973 is that the playback preamplifier in the cassette deck is intended to drive low impedance headphones via 220 ohm resistors. If the output capacitors were not changed, the bass response when using headphones would have been inadequate.

The other change in the addendum article is due to those pesky gremlins which plague us. The feedback resistor in the playback preamplifier should be 1.5M.

AUDIO OSCILLATOR: I read your description of the Economy Audio Oscillator of November, 1974 with great interest, at the start, which turned to disappointment and dismay. What a pity such an excellent design was not laid out neatly on a circuit board! If your reply indicates interest, I may send you my circuit board design. That deals with the disappointment, now for the dismay. It was commendable that you used the 555 IC as a Schmitt trigger but imagine using an imported design from "Radio Communication" for the oscillator. Mr D. S. Jones the designer may be very competent but an even simpler design has been published in the past in Circuit & Design Ideas. Why not work on his ideas? He uses a more suitable potentiometer and a simpler square wave generator too. (T. J. McR., Eastwood, NSW.)

● Due to high cost of circuit boards, we avoid their use when we consider that it is reasonable to do so. The statement that we used an imported design in preference to a local one is not really true. In point of fact, the design in question is fairly well established and individual designs differ only in detail. We elected to use a linear potentiometer as

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OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

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REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

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INFORMATION CENTRE

(Continued from p. 105)

there is less likelihood of variations between units and so they are more likely to fit in with the published dial calibrations. As for the choice of a square wave generator, this is a matter of individual choice. In short, readers may build either our design or the one given in May 1972.

STATION LISTS: I occasionally buy "Electronics Australia" and one thing I found useful was the list of Australian Broadcast stations which you published in each January issue. It seems the last time you published the list was in January 1973. Have you stopped publishing these lists or have you changed then to a different month? I would appreciate it if you would publish a new list as that for January 1973 is now out of date, especially with the addition of radio station 2JJ (R.M., Colac, Vic.)

● If we were to accept the opinions of some readers, R.M., radio 2JJ is the "only" station! Seriously though, we omitted the station lists to conserve space. Very few readers have reacted, either way. If there are more readers who wish to see the lists published, we shall certainly give it consideration.

CASSETTE PREAMPLIFIER: I wish to use the November 1973 Cassette Playback Preamplifier (File 1/PRE/28) with an Ultron 15 full track head which requires an impedance of 0.5 to 1 megohm. I would be grateful if you would let me know what alterations will be necessary in the circuit. (G.B., Glen Waverley, Vic.)

● As it stands, the cassette preamplifier circuit you refer to is not suitable for high impedance tape heads, because it cannot provide the necessary high load impedance. Unfortunately, there is no easy way of modifying it to suit the purpose nor can we suggest a suitable solid-state alternative.

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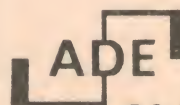
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PLAYMASTER 136: I have a problem with a Playmaster 136 which I have assembled with success. I am using a BSR C1 ceramic cartridge into one of the high-level inputs and find that bass response is just about non-existent. I tried the ceramic preamplifier you suggested in the second article on Playmaster 136, not aware that the BSR C1 has an output of the order of 250mV.

As the cartridge is new, I would be thankful if you could suggest how to increase bass boost, without the added expense of a new cartridge.

What modifications would be necessary to fit a loudness control, for low level listening? For the Playmaster 136, what would be a suitable magnetic and ceramic cartridge. Congratulations on a fine magazine. Best in the business! (R.T., Highton, Vic.)

● Thank you for the kudos, R.T. The reason why you are not obtaining a satisfactory bass response when the cartridge is plugged into the high level inputs is that these do not have a suitably high load impedance. The ceramic preamplifier you mention should be suitable for your cartridge. If there is any tendency for overloading of the preamplifier to occur, the cartridge should be shunted with small capacitors, as suggested on page 53 of the January 1973 article on the Playmaster 136.

We have not and are not likely to publish information on how to add a loudness control to your amplifier, because we regard such controls as gimmicks. See the article "Loudness Controls ... Ugh!" in the July 1974 issue.

We cannot make specific recommendations of cartridge brands. However, for best results from your amplifier, use a magnetic cartridge.

BONGOS: I have just completed the electronic bongos but cannot get them to work. All I can get is a click when I touch the plate. This click is very slightly tunable. I take it the dotted lines shown in the diagram are hook up connections underneath the tab board. I have used a mixture of 1/4, 1/2 and 1

Notes and Errata.

PLAYMASTER 3-45L SPEAKER SYSTEM (April 1975, File No. 1/SE/38). In the dimensioned drawing on page 55, the asterisk specifying an internal dimension should be deleted from the outside depth dimension of 300mm, and instead placed on the internal depth dimension of 260mm.

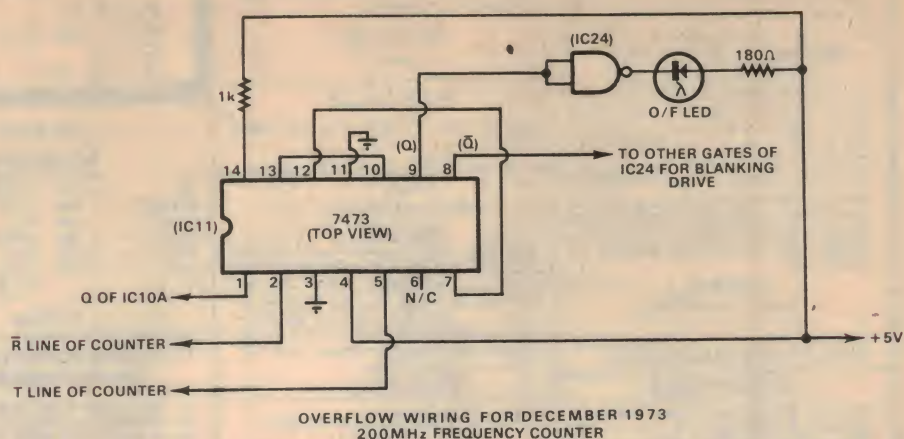
AM SYNCHRODYNE RECEIVER (June 1975): Unfortunately, a number of errors have come to light on the circuit and PC board. On the circuit: R9 and D6 should be returned to the emitter of Tr1 rather than 0V; external aerial should connect to primary of L1; there should be no connection between drain and source of F3; negative leg of P2 should go to 0V; D8 is 1N4148 instead of 1N484; IC7 non-inverting input pin 2 should be pin 3 and R26 connects to 12V before rather than after R32.

On the PC board: R1 near C6 should be R2; D5 has wrong end marked as cathode; C7 near F3 should be C8; C10 near Tr4 should be C18; C20 near V1 should be C24; R16 should be R17 and R19 next to it should be R16; R25 between C26 and R22 should be R23; D9 and D10 cathodes connect to their common point. Also the inputs to IC2 have been swapped between Tr2 and Tr4 although this makes no difference to circuit operation.

Readers unable to obtain 0A85 diodes may omit as they merely soften the turn-on of the LEDs for ease of tuning. Note that PC pattern transparencies are available from our Information Service at \$2.00.

EDUC-8 COMPUTER (December 1974, File No. 2/CC/5), also **EDUC-8 HANDBOOK:** In the description of simple tests for the conditional skip instructions given on page 79 (handbook page 35) the text overlooks the fact that the PC register normally increments once whenever ANY instruction is fetched and executed. Hence in each of the tests, the PC register should always increment, but either ONCE or TWICE depending upon the condition being sensed. In other words, where the text states "should not increment", please read "should only increment once", and where it states "should only increment", please read "should increment twice".

200MHz digital counter—addendum



In response to requests from readers for assistance in adding the overflow option to our December 1973 DFM project, we publish this diagram. It shows wiring of the additional IC, as viewed from the top.

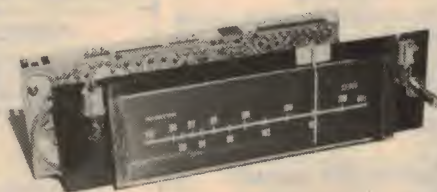
watt resistors and had to settle for capacitors 10% up on the specified value and some of 400V. Transistors used were BC548 which were supplied as BC108s. P.S.: I have just checked the resistors and find that both the 1.2M and three of the 56k are less than half their indicated value. (R.M., Ashburton, Vic.)

● Frankly, we would be rather surprised if it did work, wrong capacitor values and resistors so far off the mark. In fact, it sounds like a motley collection of components and we wonder about their age. The 400V capacitor rating would not matter but, if the capacitors are old, as well as having the wrong values, they could be leaky into the bargain. Resistor wattage rating is unimportant in this circuit, but resistance value is. Get all this right and your troubles may vanish. The BC548 transistors should be okay. Yes, the dotted lines are links under the tagboard.

CAPACITANCE TESTER: I am interested in building the capacitance section of your latest RC bridge (March 1974, File 7/B/11) but I want to use a 1kHz instead of a 50Hz AC. Have you published a circuit for a 1kHz sine wave oscillator capable of performing this duty? Would there be any other circuit changes required? Is the full size printed scale still available for the RC bridge? If so, what is the price? (C. V. Campbelltown, NSW)

● An article in the November 1972 issue of "Electronics Australia" entitled, "Convert your RC bridge to measure inductance" (File 7/B/10) has details of a 1kHz oscillator to suit the RC bridge. No further modifications are required. The printed scale of the front panel is no longer available. ②

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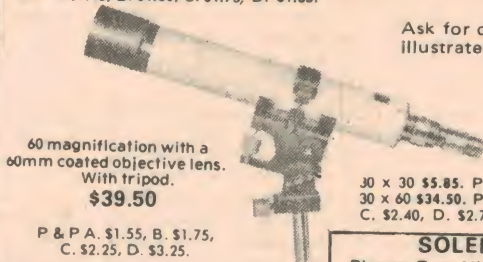
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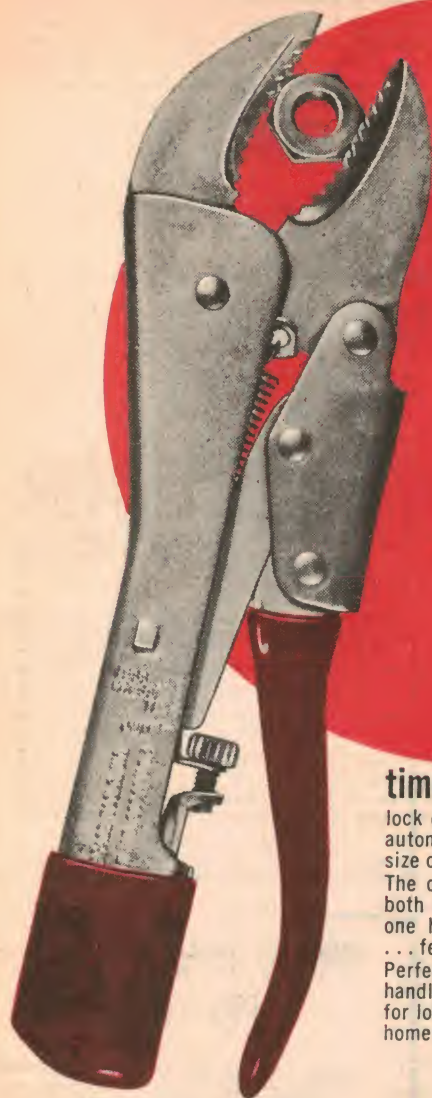
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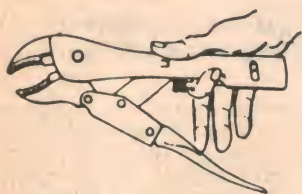
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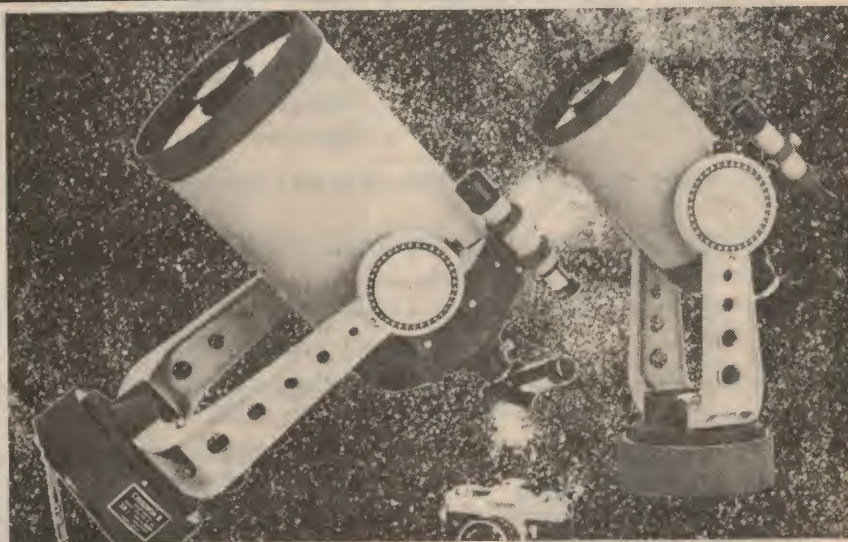
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But, naturally, the LUXMAN M-6000 is not inexpensive.

However, all is not lost. In the new LUXMAN series there are wide ranges of power amplifiers, pre-amplifiers, integrated amplifiers, tuners and tuner/amplifiers.

All have been designed with the same painstaking attention to detail — and the same manufacturing enthusiasm and precision — as the LUXMAN flagship, the magnificent M-6000.

Choose the LUXMAN model which suits your stereo budget. Listen to it critically — and make your personal comparisons in terms of both design and performance. *After all, when you choose LUXMAN, you'll be listening to it for a long time to come!*



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ID-LA175

DIRECT DRIVE

SL 120



SL 120 BASIC

- Add tonearm of your choice.
- Direct-drive brushless DC motor.
- Wow & flutter: less than 0.03% WRMS.
- Rumble: better than -50 dB [DIN A], -70 dB [DIN B].
- Fast build-up time (within 1/2 rotation at 33 1/3 rpm).
- 33 cm aluminium diecast turntable platter, dynamically balanced.
- Stroboscope speed indication on tapered rim for easier checking.
- Variable pitch controls ($\pm 5\%$).
- Aluminium diecast base.
- Audio-insulated legs.
- Removable dust cover

SL 1200



SL 1200 STANDARD

- Direct-drive brushless DC motor.
- Wow & flutter: less than 0.03% WRMS.
- Rumble: better than -50 dB [DIN A], -70 dB [DIN B].
- Fast build-up time (within 1/2 rotation at 33 1/3 rpm).
- 33 cm aluminium diecast turntable platter, dynamically balanced.
- Stroboscope speed indication on tapered rim for easier checking.
- Variable pitch controls ($\pm 5\%$).
- Precision-engineered tonearm with lateral balance and direct read-out of tracking force.
- Anti-skating device.
- Adaptable for discrete 4-channel (CD-4) records.
- Aluminium diecast base.
- Audio-insulated legs.
- Removable dust cover stays open at any angle.

SL 1300



SL 1300 AUTOMATIC

- Automatic start, stop and return.
- Memo-repeat mechanism — plays same record up to 5 times.
- Direct-drive brushless DC motor utilising the platter as part of the motor.
- Wow and flutter less than 0.03% WRMS.
- Rumble: better than -50 dB [DIN A] -70 dB [DIN B].
- Pitch control range 10%.
- 33 cm dynamically balanced platter.
- Stroboscope speed indication on tapered rim for easier checking.
- Precision engineered tonearm with gimbal suspension, "S"-shaped tubular, universal 4 pin connector, direct read out stylus pressure.
- Anti-skating control.
- Adaptable for CD4 records.
- Audio insulated legs.
- Removable dust cover stays open at any angle.

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